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VIEWS, NEWS AND INTERVIEWS

Belated members of the American Institute of Electrical Engineers, who returned from Boston on the Fall River Line steamer of Thursday evening, June 29, 1899, were treated to a rather unusual spectacle in the shape of a fine aurora borealis. The night was exceedingly dark and very clear, and the aurora was of the cloud and streamer variety, its color being a pale green. While off Newport and Narragansett Pier, the display was magnificent, the streamers rapidly flying across the sky from West to East above the numerous lights that indicated the shore line. It would be pleasant to think that this display was especially arranged for the benefit of the Institute, but it hardly seems likely.

The first industrial exposition held in the United States was given by the Franklin Institute, at Philadelphia, in 1824.

The natives of Seoul, Korea, seem to be prejudiced against the Seoul Electric Railway Company, whose line, between the Governor's palace, beyond the West Gate, through the center of the city to the tomb of the Empress Min, outside the East Gate, was completed last May. The cars, toward the end of May, killed a child and a drought afflicted the land. Whereupon the Koreans stoned the Japanese employés of the road, overturned and set fire to some cars and started to demolish the power-house. The city authorities finally stopped the fun at this point, restored order and saved what remained of the company's property. The *Korean Repository* thus explains the outbreak: "The electric wires, some say, cut off the influence of Heaven; others affirm that as the power-house is built on a sacred spot there can be no rain until the obstruction is removed." Paragraph No. 2 of the Seoul Electric Railway Company's rules provides that "women, as well as men, can ride on the cars," an innovation all the more popular, as formally Korean women were not allowed on the streets during the day.

Along a leafy lane in eastern Massachusetts, a few days ago, two enthusiasts were driving a steam automobile of the kind that superheats its exhaust and blows it back and downwards into the road. They were going nicely, about 20 miles an hour, when passing the open gate of a door-yard the unusual sound of an automobile awoke a large brindle bull-dog who was asleep in the sunshine. The dog took one look, and then made a dash at the carriage—but he didn't calculate its speed quite correctly. Instead of landing where the horse ought to be he struck its trail just abaft the rear wheels and entangled himself with the exhaust. When last seen the dog was giving an animated and vigorous representation of a pinwheel in the middle of the road. It is thought that he will not run after the next automobile that passes that way.

Mr. A. I. Prime, of New York city, accompanied by his family, finished on July 13 a trip by trolley cars from New York to Boston. The party took a car in Yonkers for New Rochelle at nine o'clock in the morning of July 11. New Haven was reached the first day. The next morning the trip was continued through Hartford to Springfield, from there to Worcester, where the second night was passed. The last stage was accomplished on July 13, the 48 miles to Boston being done in a little over five hours. The trip took about 29 hours, exclusive of stops. Two hundred and five miles were covered by trolley and only 52 by train. Thirty different lines were passed over.

The town of Manchester, N. H., has decided not to put in electric lights, principally on account of the objections of Summer residents, who dislike the appearance of poles along the thoroughfares.

NEW RAILWAY CONDUIT CONSTRUCTION IN NEW YORK CITY.

RECENT TRACK AND CONDUIT WORK OF THE METROPOLITAN STREET RAILWAY COMPANY.

On the new line of the Metropolitan Street Railway Company, extending along the northern portion of Broadway (formally called the Boulevard), in New York city, a new type of conduit construction is being installed, which presents many features of interest, and is probably superior to the older construction which this company has laid down on many important lines. The three illustrations presented herewith show the conduit in several stages of construction. The principal difference between the new work and that which has been put down is in the yokes. These are well illustrated in the middle figure of the three on this page. Instead of a solid cast-iron construction, such as has been formerly employed, the new yoke is built of two side castings solidly riveted to a section of six-inch I-beam, the lower edge of each casting being secured to the beam with six rivets. Their general form and appearance may better be understood by reference to the illustration than by description.

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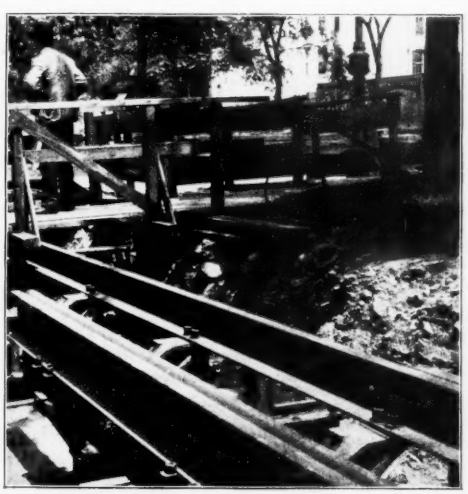
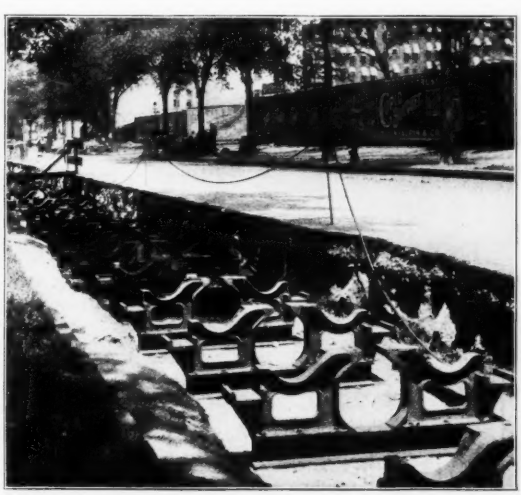
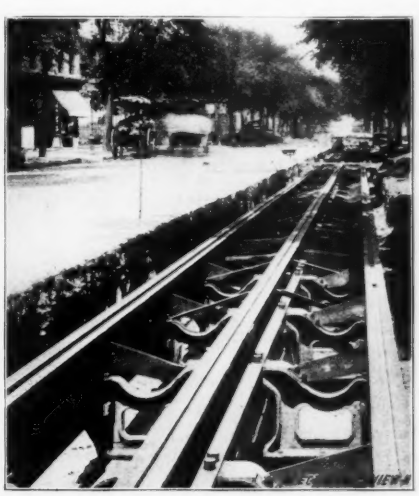


RAIL ON WOODEN STRINGERS, SHOWING LONG BOLTS AND NUT LOCKS.



YOKES IN THE TRENCH READY TO RECEIVE STRINGERS.



YOKES, STRINGERS, RAILS AND SLOT-RAILS READY FOR CONCRETE.

NEW TYPES OF CONDUIT ELECTRIC RAILWAY CONSTRUCTION IN UPPER BROADWAY (BOULEVARD), NEW YORK CITY.

of each yoke is laid a stringer of yellow pine thoroughly soaked in creosote. This stringer is 6x6 inches in size, and flat upon the top of it is laid the nine-inch, 107-pound grooved girder rail. The construction is very clearly shown in the left-hand figure. The stringer is held down in place on the yoke by two straps at each yoke, and long bolts are run through the yoke and strap to nuts which clamp the web of the rail, a substantial lock-nut being inserted under each. The slot rails are bolted to the yokes with two bolts at each yoke, the same type of lock-nut being employed in this case. The conduit is finished in the usual manner with concrete made of broken stone and cement.

The advantage of this particular type of construction is that the whole structure is shortened vertically, thus making the depth of excavation required much less, and avoiding many pipes, etc., underneath the surface, which would otherwise have to be moved at great cost. The work on the Boulevard line is progressing with great rapidity, and it is expected that cars will be in operation over it in about four weeks.

Automobile Issue in Boston.

Mayor Quincy, of Boston, has vetoed the amendment to the revised regulations by which the Aldermen sought to obtain control of the licensing of automobiles. The regulation, as amended and passed on June 29, was as follows:

"No person shall, in any street, use any vehicle other than a railroad or a railway vehicle, or a vehicle of the Fire Department, or a vehicle drawn or pushed by an animal, or a vehicle of a construction approved by the Board of Aldermen as not endangering the life or property of others."

That amendment, which was offered by Alderman Adams, caused a warm debate in and out of secret session. It passed by a vote of seven to five, the "Big Seven," so called, being solid in its behalf. Aldermen Colby tried in vain to secure the adoption of this addition to the section:

"Provided, however, that nothing in this section shall be so construed as to authorize the Board of Aldermen to grant a permit for the use of vehicles propelled by one system of motive power to the exclusion of other systems of motive power."

Whether it will be possible to pass the regulation over the Mayor's veto remains to be seen. One more vote is needed.

Effects of a Lightning Stroke.

To the Editor of Electrical Review:

I send you herewith a photograph, showing the effects of a lightning stroke, during a thunder shower on May 28 last. The particulars, as far as I could trace them, are as follows:

The house struck was that occupied by my father, Rev. Lea Luquer, at Bedford, Westchester County, New York. Of course, it is impossible to state whether the lightning entered or went out at any particular parts of the building. For convenience, I will describe the passage of the bolt or bolts as follows:

The lightning entered on the west side of the house, where the tin roof

Curious Effects of a Lightning Stroke.

of a piazza meets the building just outside of the corner of the room shown in the photograph. It made a hole about three-fourths of an inch in diameter through the plaster in the corner next the ceiling, just above the part of the wall taken in by the photograph. There were faint markings on the wall over to the picture-nail, from which were suspended two pictures in gilt frames. The upper picture had the gilding of the frame fused and discolored, as shown in the photograph. The lower picture also had its frame similarly damaged, and the picture-wire from which it was hung was fused on both sides over a space of about six inches. The bolt apparently passed from the corner of the frame of the lower picture over to a bell-push on the side of the door-frame shown in the photograph. A scorched effect can be seen on the wall in the photograph. The bolt then followed the bell wires out into the hall and fused them at one point; then passed on to the kitchen, where it opened the circuit of an electric bell.

On the east side of the house, either the same bolt or another one entered at the point where another tin roof joined the side of the house, just under the eaves of the roof. It splintered a beam in the attic, driving some splinters about a foot in length for more than 20 feet across the floor. It then followed down the rope of a dumb-waiter, bursting out the shaft in which the rope was contained, and also damaging an adjacent wall. This dumb-waiter rope passed within about four feet of the electric bell in the kitchen above mentioned.

Only one crash of thunder was noticed. The house was filled with a considerable amount of smoke and a strong smell of ozone, but no fire resulted.

Yours very truly,
Thatcher T. P. Luquer.
New York, July 13.

Four Thousand Two Hundred Electromobiles Ordered.

Mr. Isaac L. Rice, president of the Electric Vehicle Company, of New York city, stated on July 12 that he had placed orders for electric carriages of various sorts, the total cost of which would be $8,000,000. The orders were given to the Columbia and Electric Vehicle Company, and call for 4,200 vehicles, which, Mr. Rice said, would not begin to supply the demand. The delivery of the vehicles on the orders will begin the latter part of this month and will go on regularly until the order is filled.

The contract would be an exceptionally large one in any line of business, but it is of special importance, inasmuch as it concerns what is comparatively a new industry. It is expected that the manufacture of these vehicles will give a perceptible impulse to business in the localities where the work is done. As stated above, the first of the new vehicles are expected in a few weeks, while it is intended to have over 1,000 ready for service by the end of the current year.

Of the 4,200 vehicles ordered, about 200 will be delivery wagons. The remainder will be passenger vehicles, of which about half will be runabouts, golf traps and victorias, and the other 2,000 landaus, hansoms and broughams of varied design.

The contracts have been given to the various manufacturing companies controlled by the Electric Vehicle Company. The capacity of these plants, however, is not at the moment sufficient to turn out the vehicles as rapidly as desired, and consequently a part of the work will be turned over to other companies. The Studebaker Carriage Company, of South Bend, Ind., will furnish much of the body work. The accumulators will be made by the Columbia Automobile Company, which some time ago obtained exclusive rights from the Electric Storage Battery Company, of Philadelphia, for the manufacture of batteries for electromobiles. The motors will be built at the Siemens-Halske shops, in Chicago, which plant was recently purchased by Electric Vehicle Company interests. The other work will go to the Columbia and Electric Vehicle Company. This company some time ago secured the motor carriage department of the Pope Manufacturing Company at Hartford, Ct., and recently purchased by the New Haven Carriage Company. A small part of the work will be sublet to other carriage companies.

Representatives of the Electric Vehicle Company claim that they could now use the entire number of vehicles ordered. The company's manufacturing concerns are to be enlarged, and it is stated that by next year these will have a capacity of 100 electromobiles a day. It is also said that a larger number of vehicles would have been ordered at the present time if the manufacturing companies could have handled the business.

Automobiles Barred at Bar Harbor.

The motor carriage has been virtually barred out of Bar Harbor, Me., the aristocratic Summer resort. Under the present laws it is not legal to pass a regulation absolutely prohibiting their use. The by-laws recently passed make it impossible for an owner of a motor vehicle to run his machine in Bar Harbor during the hours from 10 A. M. to 10 P. M., and only on little lanes and alleys at a speed not greater than five miles an hour, and then only after the machine has been licensed.

After passing these by-laws, which referred to any vehicle propelled by machinery, it was suggested that the regulations adopted made the running of a road roller illegal, so the citizens passed another by-law to permit them to be used.

It is a relief to be assured that there is not likely to be any Society for the Prevention of Cruelty to Automobiles—*Life*.

Crazy Speeds.

Our French contemporary, *L'Energie Electrique*, prints, under the above title, an account of recent attempts by two famous French *chauffeurs* to lower the automobile speed record. It is unfortunate that our language does not allow the delicate Gallic flavor of the original to be preserved.

"In the aftermath of the automobile concourse, and while we are going through this season of *dromomania*, it seems interesting to publish the last kilometre 'record' for electromobiles on ordinary roads—a record held for some months now by Camille Jenatzy.

"As has been told before Jenatzy beat the Compte de Chasseloup-Laubat in a race with their ordinary electromobiles. After his defeat, on January 27, the Compte de Chasseloup ordered from the Jeanteaud establishment a new machine, relatively very light, composed simply of a truck supporting a body shaped like a steamboat, and with which, through the aid of a battery of Clerc-Pingault accumulators, being only a few ampere-hours capacity but able to stand a tremendous discharge for several minutes, the young and audacious electrician sought to regain his lost prestige on March 4 last. He reduced the time for one kilometre to 38 seconds (corresponding to a mile in 61 seconds). This speed seemed, then, extravagant and unsurpassable.

"For some weeks Jenatzy remained in coy obscurity, finishing the construction of a strange machine which the sportive press at once baptized as 'Torpedo,' 'Cigar,' 'Projectile,' etc., it having the aspect of any of these various objects, according to the way one looks at it. The names 'Torpedo' and 'Projectile' fit it best, for it 'gets there' with the promptness of a 10 inch shell. These tournaments of the modern chevaliers of the electric fairy have no particular technical interest, but we chronicle them . . . for the future. Jenatzy having called his new machine 'La Jamais Content' (The Never Satisfied), an epic performance was to be looked for on the deserted track at tho Achéres field. We well remember the first joust of this sort, on the 18th of last December, in an icy gale from the North. The time for a kilometre was then set at 57 seconds. At the moment it has fallen as low as 34 seconds, corresponding thus to a speed of 106 kilometres an hour (66 miles an hour). This record was made on April 29, 1899, a date to remember, until the greater prowess of somebody makes a new one.

"In spite of the uncertain weather a crowd gathered at Achères to assist in the performance of Jenatzy. The record-maker was there with his blue-gray racing machine—a veritable projectile mounted on ridiculously small wheels. It was built by the Compagnie Générale de Transports Automobiles from Jenatzy's own plans. Scattered along the course were half the electromobile *cracks* of France.

"A fine rain which had been falling had just ceased when the record-breaker started. It was about three o'clock when the 'Cigar' was brought to the line ready to start. Aboard of it Jenatzy waited impatiently the signal. Réne de Knyff, who fulfilled the functions of starter, gave him

THE FRENCH ELECTROMOBILE THAT BEAT A MILE A MINUTE.

the last directions—the last farewells, somebody in the crowd called them. Far down the road, between two lines of people and vehicles, two white flags are vigorously flapping.

"'Father' Willemenet, who holds one of the official chronometers, is superb in his tranquility, while poor Jenatzy, to whom seconds seem minutes, anxiously looks ahead over the road he is to devour.

"'Attention, Jenatzy; get ready,' says de Knyff.

"But Jenatzy listens to no more. His hands clinched on the control handles are trembling nervously.

"'Go!'

"De Knyff dropped his arm. Willemenet started his chronometer, and frrrrou! The 'Cigar' sprang away. Ten yards further it seemed to give another leap and was lost to sight in a whirling cloud of dust.

"At the first kilometre mark, where we stood, Jenatzy was in full swing, the electromobile skimming over the road almost as if it were not touching the surface. The record-breaker was going beautifully. One could see the machine a point on the horizon coming like a shot and passing in a whirlwind, with nothing left but two white tracks on the soil—as straight as if they had been ruled. One has only time to bend forward, to glance, to throw up his arms and yell, and Jenatzy is gone to burst a hole in the far horizon.

"'Gotferdom!' cries Cordang.

"'Jésu-Marie!' whispers a peasant on the road-side, crossing himself. . .

"The time of Chasseloup-Loubat was not exactly easy to beat; 38⅗ seconds for the kilometre with a flying start, 48⅘ seconds from rest. The new champion of the accumulator made his kilometre, from rest, in 47⅕ seconds, and the next in 34 seconds—at a speed higher than that of an express train."

An Electromobile Patrol Wagon.

It is reported that the police department of Akron, Ohio, has ordered an electromobile to be used as a patrol wagon.

Another Electromobile Gets Arrested.

A driver of an electromobile was arrested in New York city, on July 10, for running his vehicle on Fifth avenue at higher than the legal rate of speed.

A New Automobile Factory.

It is said that $10,000 has been paid as earnest money on the purchase of the Elgin Sewing Machine and Bicycle Works, Elgin, Ill., long idle. The buyers are automobile manufacturers, who will start work next week in the factory.

Electromobile Express Wagons in New York City.

The United States Express Company will soon have in the streets of New York an electromobile express wagon, or truck, which may in time bring about a revolution in the express business.

Express company officials have for some time recognized that the electromobile is the ideal means of transportation for local delivery in large cities, as well as for suburban work. This feeling has led the United States Express Company to have constructed a motor vehicle after a special design. This vehicle has already had a trial in Chicago and Baltimore, where it has done meritorious work. It has been brought to New York because here conditions for its advantageous use are favorable in all respects. It will soon be put in active use on local work. In the event that it proves satisfactory from a standpoint of comparative cost, the horse wagons will probably be abandoned for the speedier and more powerful electromobile.

The Automobile Industry in Great Britain.

Early in the century, before railroads were constructed, says *Industries and Iron*, the idea of conveying passengers and goods by means of steam power along the king's highway was attractive to many inventors. Highly ingenious were some of the results of their experiments, and the vehicles of Gurney, Hancock and Church, cumbersome though they were when compared with modern designs, deserve some recognition, when the state of mechanism generally in their day, and the limited facilities which they had, are considered. The legislation which allowed the Continent to proceed ahead of Great Britain in this matter having been removed, great progress has been made within the last two years.

With the advent of any new industry there are always features that retard its progress—exalted notions of immediate success, undue anxiety to be first in the field with new inventions, even though unfinished, and the attendant speculation almost inevitably cause disappointment to some. But while some of these causes have prejudiced a section of the public against the coming method of locomotion on ordinary roads, the initial errors have been overcome, and the motor vehicle is now recognized as a practical means of dealing with traffic problems. Far more convincing than the parades that have been made is the fact that several services of public motor cars have been successfully inaugurated in various centers of business and places of holiday resort, and hardly a town of any importance is without a firm enterprising enough to adopt the motor vehicle for ordinary business purposes. The number of these is growing, and only this week we hear of the establishment of a motor-car service in Sheffield.

In the present stage of the industry, exhibitions are not only useful, but absolutely necessary. They enable the public to see what is being done, and tend to give general confidence in the future of the industry, but they also enable manufacturers and others interested in the industry to compare notes and to keep themselves acquainted with the best notions of construction and design. Hence, while educating the public they educate those who cater for the public, and so do much to improve the general character of automobilism.

It is said that electromobiles will be used by the Boston post office for the collection of mail matter.

SCIENCE BREVITIES.

Magnetic Observatory Disturbances—The observations at the Magnetic Observatory at Vienna have had to be discontinued on account of the electric tramways and electric light wires. *Terrestrial Magnetism* states that the Director of the Observatory, Professor Pernter, has submitted a plan to the Austrian Government for a new observatory, to be situated some distance from Vienna, and to be provided with instruments of the latest construction.

Utilizing Blast-Furnace Gases—The subject of the utilization of the gases from blast furnaces is one that is worthy of more attention probably than it has hitherto received in this country. Some figures were recently given in *L'Eclairage Electrique*, by M. Witz, showing the great waste of energy which accompanies the loss of blast-furnace gas. Furnaces of 100 to 200 tons capacity are not rare, there being one in the United States using 700 tons every 24 hours, in which the material for combustion is reduced to three-fourths of a ton per ton of iron. A thermic balance sheet shows that the charge of about 92,000 kilos of coke contains 629,000,000 of heat units: to this must be added 416,000,000 which are recovered from the reheaters, making a total of 1,045,000,000. Those consumed by the chemical reactions in the furnace amount to 182,000,000; those utilized for reheating 473,000,000; those utilized for the production of steam 50,000,000, leaving about 340,000,000 of calories, or over half those in the coke, as wasted energy escaping with gases. The portion which develops steam for the engines is utilized very uneconomically at a rate of at least 22 cubic metres of gas per indicated horse-power hour, which is at the rate of only about three per cent efficiency.

Advantages of Automobiles—Among the various advantages which are attained by the use of automobiles, one of the most important, says the *Revista de Obras Publicas*, is the improvement in sanitary conditions in great centers of population. In effect, the greater part of the dust and dirt of cities is due to the use of horses. The horse, in addition to this, contributes in many ways to the diffusion of disease. He assists in grinding, with his iron shoes, the stony surface of the only kind of streets upon which he can perform his work into a dust which, becoming wet and mixed with organic matter, forms a culture-medium for all manner of hurtful bacteria. Seeing that the retirement of the horse will mean less dirt and cleaner streets, it will reduce municipal expenses in proportion, and also conserve the large quantity of water now needed for street sprinkling and cleaning. In many places this is a factor of considerable importance. Another advantage that is not generally reckoned upon is that the storage space required by the automobile is much less than that required for a similar vehicle drawn by a horse. With the automobile the storage of the vehicle itself ends the matter; with the horse-drawn vehicle storage must be provided for the horse, or horses, and feed. It seems fair to say that such carriages occupy more than twice the space that will be required by corresponding automobiles. By reason of this smaller size—the shortening of the vehicle by the leaving off of the horse—the room occupied in the streets will be correspondingly decreased, or, in other words, the capacity of any given street will be correspondingly enhanced.

Grinding a Great Mirror—The operation of grinding of the great flat mirror, 78.7 inches in diameter, for the siderostat telescope, which is to form one of the features of the Paris Exhibition of 1900, is described in a paper recently read before the Paris Society of Civil Engineers by M. P. Gautier. A notable feature of the work is the fact that the final figure was obtained by pure mechanical means, no local corrections being made by hand, as is usual. The machine used resembled in construction one of the large vertical boring mills now common, but the cross slide carried the grinding or polishing disks in place of cutting tools. It was found that to avoid scratching the grinding disk must not touch the glass. When grinding in the last stages of this portion of the work, a distance of one six-hundredth inch separated the two, the grinding material being fed in between. The polishing was done in the dry with tripoli powder. Some difficulty was met with in this operation, owing to the heating of the mirror by the friction, and a consequent change of form. This heating was reduced by separating the polisher and the work as in grinding, the best distance between the two being found to be one six-hundredth inch. Even so, change of form through heating was not avoided, although the plan of polishing for one minute and then resting for 30 minutes was tried. In spite of all these precautions, however, the mirror "convexed" with the heat during the operation, and was thus concave when cool. Finally, the plan was adopted of bending the cross-slide, by an amount sufficient to correct the hollow thus produced. This was accomplished by suitable applied weights. The total flexure needed to correct the error was represented by a deflection of one-fiftieth inch in the middle of a length of over six feet. In the end very perfect results were obtained, and M. Gautier accordingly is of the opinion that this method is superior to the more ordinary one of hand figuring. The flatness of the surface was tested by Foucault's system. In this the image of a round luminous point, as reflected from the mirror, is observed in a telescope. If the mirror is flat, the image, as seen in the telescope, will be circular and sharp, and surrounded by diffraction rays, also circular. If put slightly out of focus, the image will still be circular, though not sharp. If the mirror is concave, the image, in place of being round, will be flattened. The sensitiveness of the method is shown by the fact that the touch of the hand for a few seconds will deform the mirror sufficiently to distort the image as described. In fact, irregularities of form not exceeding one two-hundred-and-fifty-thousandth inch can be readily detected. This mirror will be used for testing the lenses with which the telescope is to be provided. There are to be two of these object-glasses, each 53.15 inches in diameter, one being intended for photographic work and the other for direct vision. The focal length of the objectives will be 196 feet, so that excellent definition and great magnifying power may be expected; in fact, to use a popular illustration, this telescope will bring the moon within a distance of 36½ miles. The telescope tube being fixed, this great focal length will cause no difficulty in using the instrument.

Electrolysis Induced by Roentgen Tubes—MM. H. Bordier and Salvador have endeavored to get at the true cause of X-ray "burns," which have so often interfered with the safe surgical use of the rays. In a recent communication to the Académie des Sciences, abstracted by M. Fournier d'Albe, they describe their investigations. Proceeding from the supposition that they were due to the waves produced by the making and breaking of the induction-coil circuit, they argued that, owing to the greater intensity of the oscillations induced by the break, a practically unidirectional current would be induced in neighboring conductors and electrolytes, and would, in the case of the latter, lead to electrolysis. To test this conclusion they placed an electrolytic cell in the neighborhood of the Roentgen tube, with its electrodes near those of the vacuum tube. The cell consisted of copper sulphate with copper, or zinc sulphate with zinc electrodes. After about a quarter of an hour of excitation the electrodes were connected with a galvanometer, and a deflection was obtained indicating a current in the external circuit proceeding from the copper facing the anode of the vacuum tube to the copper facing the cathode. This confirms the above conclusion. No difference is observed when all Roentgen rays are hindered from reaching the electrolyte. The effect is, therefore, not directly due to them. The polarization obtained diminishes when the distance of the electrolyte from the tube increases, and when the internal resistance of the tube decreases.

Electro-Motive Force of Magnetized Flames—M. R. Blondlot describes, in *Comptes Rendus*, an elegant experiment, which is the converse of the curvature of the electric arc. The London *Electrician* thus abstracts his description: A fish-tail gas burner is provided with two platinum electrodes, which dip into the ends of the flame and are connected with the terminals of a capillary electrometer. No action is observed except a slight oscillation due to unavoidable variations of temperature. But when the flame is introduced between the pole-faces of a powerful electro-magnet, say, one inch apart, and large enough to create a uniform field, a steady displacement of the meniscus in one direction is observed. On reversing the magnetizing current, the displacement is reversed also. The magnetized flame is, therefore, the seat of an electro-motive force directed from one end of the flame to the other, the direction being given by the following rule: A man lying on his right side, along the flame, and looking at the south-seeking pole of the electro-magnet, will have the electro-motive force directed from his feet to his head. The explanation of the phenomenon is quite simple. The flame gases constitute a conductor moving at right angles to the magnetic lines of force. Here there is an electro-motive force along the flame. The flame represents, in fact, a thermal motor and a magneto-electric machine at the same time. A converse reasoning explains the curvature of the electric arc.

THE PUBLIC ELECTROMOBILE STATION IN PARIS.

THE NEW CHARGING AND STORAGE STATION OF THE COMPAGNIE GÉNÉRALE DES VOITURES.

The establishment of a public electromobile service, for which Paris has impatiently waited, is at last accomplished, and the electromobile has taken its place as a factor in the transportation of passengers in the city and can no longer be regarded as an experiment. While it is true that the type of accumulators to be finally used has not been definitely decided, and several makes are being tried, still the satisfactory operation of a large number of vehicles is a guarantee of future progress, and allows the collection of many practical data.

The work of the Compagnie Générale des Voitures began with a small station in the Rue Cardinet, where the accumulators of the vehicles were charged, and also where the training of the future drivers was carried on. The current used was taken from the mains of the Clichy station, at a pressure of 440 volts, which was transformed to 110 volts by a motor dynamo. From this installation a dozen or more electromobiles, which number was considered sufficient during the preliminary and experimental stage, could be charged. Three months ago, when the company put in operation about 100 electromobiles, the generating station upon the Rue du Pilier at Aubervilliers was opened and now furnishes all the electrical energy required.

The station comprises, in addition to the boiler and engine-rooms, a large charging-room and storage accommodations for over 200 electromobiles of various types. The engine-room is 64 by 96 feet in size, and 35 feet in pitch, and is of steel construction. In this room are installed two single-cylinder 250-horse-power engines, which are belted to Alioth dynamos. These have Corliss valve-gear and are run condensing, the condenser being placed below the floor and supplied by the usual circulating pumps. It is found at present that one of the engines is sufficient to take care of the service when operating about 19 hours per day.

The dynamos each supply 1,250 amperes at 120 volts, the main switchboard from which this current is distributed being located in a gallery, upon which open the test-rooms and the office of the engineers in charge.

The boiler-room is 36 by 96 feet in area, and contains two water-tube boilers having a total capacity of 2,000 horse-power. These are intended to supply the plant when it has reached a considerably larger growth. A brick chimney 128 feet high completes the steam installation. An artesian well 240 feet deep supplies water for boilers and condensers.

The charging-building, which is next the engine-room, is built of brick and wood, and measures 82 by 130 feet on the outside. Along one side is a kind of shed under which the electromobiles coming in empty are ranged, while three hydraulic elevators, each capable of elevating one ton, raise the exhausted batteries to the second floor. The accumulators when taken out of the electromobiles are slid upon a truck, which is then placed on the elevator, and at the upper level can be moved laterally upon a transfer table. This arrangement permits 108 sets of batteries to be charged on the upper floor, and 52 on the ground level. The hydraulic elevators are of the simplest possible type, each consisting of an ordinary cylinder having a plunger piston upon which is mounted the platform. The city water supply is of sufficient pressure to operate these elevators directly.

Behind the buildings described above is a carriage-house, now capable of accommodating 200 electromobiles, but which can be enlarged to a capacity of about 1,000. This is of fireproof construction, in brick and iron, and at one end of it is a machine-shop containing the necessary tools, lathes, planers, drills, etc., all electrically driven, for repairing electromobiles.

The type of electromobile in use is strikingly similar to the closed or brougham cabs in use in New York city. The total weight of the vehicle is about 4,400 pounds, of which the battery weighs 1,760 pounds and the motor 220 pounds. The motor runs at 1,500 revolutions per minute, at which it exerts from four to five horse-power and gives the vehicle a speed of 9.4 miles per hour. The motors are of the Lundell type. The winding is double, each motor having two commutators, and regulation is effected by various combinations of these windings in series and parallel.

The station described above is intended to be the predecessor of several more to be established at various points in the outskirts of Paris. It is interesting that Paris, the home of the electromobile and the city in which the greatest interest in such apparatus has always been exhibited, should be behind New York in the establishment of a general public electromobile service.

A Ride in a "Steamomobile."

A few weeks ago, when the ELECTRICAL REVIEW was in the throes of a name contest, Prof. Elihu Thomson suggested that if electromobile was a good name for electrically driven vehicles, "steamomobile" would be a good name for those in which steam was the motive power.

At his laboratory in Lynn, Mass., Professor Thomson has a "steamomobile," whose portrait is presented in the accompanying illustration. The machine has a most innocent and guileless aspect. It looks like any other automobile, except in having a certain businesslike air, and in being low-hung, which is an exceedingly fortunate circumstance.

A representative of the ELECTRICAL REVIEW, during the recent session of the American Institute of Electrical Engineers in Boston, called upon Professor Thomson. The gentleman associated with him in the construction of the steam carriage—we will call him Mr. X in this connection—suggested taking a spin on the machine. It was wheeled out into the road and started at a respectable pace through the streets of Lynn, working beautifully, making very little noise, and as well as the rider was able to perceive, not leaving behind a trail of malodorous gases, as is the custom of such machines.

PROF. ELIHU THOMSON'S STEAM AUTOMOBILE.

Once out of the middle part of the town, Mr. X, without warning of any sort except a sudden command to "hold fast," put on the full power of the machine and ran five miles through the streets, up hill and down, across trolley tracks, dodging baby-carriages, ice wagons, trolley-cars, pedestrians, etc., in 12 minutes! The spurts were made at the rate of about 36 miles an hour, and a speed of well over 30 miles per hour was attained going up a 10 per cent grade. As a demonstration of the powers of the automobile the trip was a magnificent success, but the unfortunate passenger had but one thought during the greater part of it, which was a hope that something would slow the machine sufficiently for him to jump out with safety.

Professor Thomson thinks that in the steam machine is the solution of the automobile problem. It is certain that he has succeeded in constructing a very satisfactory steam automobile, capable not only of high speed, but of sustained runs.

The fuel used is common kerosene oil, of which a sufficient supply for a 60-mile run is carried at one charge. Water must be taken on every 40 miles. The details of the machine are not yet available for publication, but it is a model of simplicity, and shows an extraordinary efficiency by reason of its peculiar cycle of operations, somewhat similar to those of a gas engine.

ITEMS OF INTEREST.

Thomas, W. Va., will erect and operate its own electric light plant and water system. The Mayor can give information.

H. M. Herbert, of Cambridge City, Ind., and R. Ellison, of Lagrange, have purchased the plant of the Hartford City Light and Power Company for $35,000.

The Boston, Milton & Brockton, Mass., Street Railway Company has been authorized by the railroad commissioners to issue $40,000 additional stock and $100,000 bonds.

The Mercantile Trust Company, of San Francisco, has taken $1,000,000 of the bonds of the Yuba Electric Power Company. They are to run for 30 years, and are secured by a trust deed of the power company's plant.

At Muncie, Ind., a $5,000,000 mortgage has been filed for the Union Traction Company to the City Trust Company, of New York city. The mortgage cites that the traction company now owns and controls electric lines in Marion, Alexandria, Elwood, Anderson, Muncie, Jonesboro, Gas City, Summitville and Orestes.

The Harper's Ferry Electric Light and Power Company, at a regular meeting of the stockholders, June 24, elected the following officers: T. H. Savery, president; W. H. Savery, vice-president, and T. H. Savery, Jr., secretary. The new board of directors contains all the members of the old board, with the addition of W. H. Savery and T. H. Savery, Jr.

It is said locally that Middendorf, Oliver & Company, of Baltimore, who with others have recently purchased the property of the Virginia Electric Company at Norfolk, will remove the electric plant at Huntersville and the plant at Oakwood to Norfolk, to be made a part of the Virginia Electric Company's plant. It is stated that the owners intend to install a complete double plant with a capacity for furnishing all the electric power and lights that may be needed in the near future in Norfolk and vicinity.

Electrical Review

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News, Subscriptions and Advertisements.

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week, although it is occasionally possible to get in matter received on Monday.

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A NATIONAL AUTOMOBILE ASSOCIATION.

In these columns, last week, a suggestion was made for the formation of a national association of automobilists for the general protection of their rights and the advancement of their interests. It is gratifying to note that this suggestion has already borne fruit, and that a considerable popular interest is being taken in the formation of the association.

The reasons which make the organization of a body of this sort desirable at this time are almost too evident to require presentation here. Still it is worth while to call attention to some of the salient features of the present situation.

The slower progress of municipal ordinance has not been able to keep pace with the exceedingly rapid evolution and perfection of the automobile. In England there has been won recently a long and hard fight against the restriction which placed automobile vehicles in the same category with traction engines and road-rollers—requiring a man with a red flag to walk a hundred yards ahead of each machine to warn people that the dangerous engine was approaching. Permissive automobile legislation is needed in many states and nearly all cities. There seems to have been recently a wave of municipal opposition to automobiles, and the commissions in charge of parks in several of our larger cities have been compelled to suffer the discipline of the courts before they would see reason. There are many interests which are in apparent conflict with those of automobilists, and it is not to be doubted that certain classes of horsemen will endeavor to assail both the popularity and the development of the automobile in every possible way. There is need, therefore, both for legislation and wisest municipal regulation, and also for missionary work to be done with the press and among the general public. To the large majority of the latter the automobile is still a curiosity. To familiarize them with the machine, to teach them the immense and wide-reaching advantages that will follow its general use, to popularize the automobile so as to create among the masses of people a demand for such vehicles, resulting naturally in cheapening and bettering their construction, will be a few among the many good works which the association that has been outlined can perform.

All these things are now being undertaken by various users and makers of automobiles, and by small societies of only local extent in various parts of the United States and Canada. If the effort that is thus diffused can be properly concentrated, the effectiveness of the work done will be vastly enhanced, and results will be obtained with far less trouble and expense. The concentration of effort will give to a strong general organization the ability to employ the highest grade of legal talent, to present its case with far more impressive strength, to interest the public to a greater degree through its stronger hold upon the press, and also to discover the majority view of automobilists upon the many questions which are still under discussion among them. It is, perhaps, possible that the engineering side of the subject also may be greatly benefited by such an association. In one respect—standardization of parts and sizes—the concerted action of manufacturers and users would bring about an immediate cheapening of the machines. There are many pitfalls that lurk in the way of the association, the possibility of some conflict between the interests of electromobiles and self-propelled vehicles moved by oil and steam being among them. These questions can be safely left to the future and to the association. What is needed now is the formation of a strong society, national in extent, and having for its sole purpose the improvement of all the conditions surrounding the automobile, whether from the point of view of the maker or that of the user.

It no longer can be doubted by anyone who has watched the development of the electrical arts during the last 20 years that the history of the automobile will be closely parallel to that of the electric light, the telephone and the electric street railway. All these great industries have started with small beginnings, have grown with almost incredible rapidity, gathering strength as they grew, until to-day they are among the most important branches of industry. The immense field for the automobile makes it almost certain that the growth of this latest application of engineering science will be as large, if not larger than that of the other industries mentioned above. In the early days of both electric lighting and electric street railways it was found that such organizations were necessary, and experience with them has shown that they were of immediate and great benefit to their respective arts. The same will be unquestionably true of the National Automobile Association. There can be no reason alleged against the formation of such a society, while every indication points to the importance and, indeed, to the vital necessity of an immediate gathering together of the various interests and their amalgamation into a powerful organization which will be able to advance the interests of the automobile in all directions.

From all parts of the country reports are coming in of dividends declared by electric lighting and street railway companies. This encouraging and satisfactory state of things shows that the electrical industry is back again on its old basis, after the unsettling experiences of the past few years of financial and business depression. There is every indication that it will continue to hold this place indefinitely—for no form of industrial activity has greater or more stable earning power than the application of electricity to the various arts.

What is the proper name for the act of superintending the propulsion of an electromobile? It is not driving, nor is it altogether steering, nor yet wholly controlling. Does one ride an electromobile, or does he drive it, steer it, control it, or what?

In Favor of a National Automobile Association.

To the Editor of Electrical Review:

We think the suggestion of an automobile convention, to take place some time this Fall, a very good one.

Yours truly,
Automobile Company of America,
E. T. Kimball.

New York, July 17.

To the Editor of Electrical Review:

I see that you have issued a call to those who are interested in automobiles to meet in New York in September. Is any date fixed? I shall have one as soon as one can be obtained, and I shall put some money into the business of making them. I do not want some cheap city official or country "selectman" ordering my carriage from the streets where horses are allowed to go, and I do not propose to have it lawful to do so if I can help it.

I think we can get our rights by organization. Keep this matter moving, and we will get together and settle the maxim that motor vehicles (Boston) are safer and better on a street than horses.

Yours,
Chas. Allen Taber.

Boston, July 13.

To the Editor of Electrical Review:

I believe that an automobile association would be a good thing. While it is difficult for me to make any promises so far in advance, I will say that I should try to be present at a meeting intended to promote an organization for the protection of the interests of automobilism and the furtherance of permissive legislation.

I think that the cultivation of a popular sentiment in favor of the automobile will be the greatest factor in securing proper conditions.

I would not, however, favor entire absence of all restrictions as to speed, experience on the part of the "mobileer," construction of machine, or the like, for I think that if any one thing will do harm to the cause it is accidents arising from excessive speed (racing), inexperienced handling, and bad structure of machine, particularly as to the steering gear and wheels.

Very truly yours,
Elihu Thomson.

Swampscott, Mass, July 17.

To the Editor of Electrical Review:

Your favor of July 14 was duly received, and I have noted the editorial in the Review of the 12th instant.

I have long contemplated bringing this matter before the other manufacturers of motor vehicles, but did not think the industry was quite far enough advanced to warrant it until the past few months, when the public have begun to take such general interest in the subject of automobiles, and the orders have been pouring in so rapidly, that I am convinced that immediate action is necessary.

You can count upon my hearty cooperation in all matters furthering the interest of motor vehicle manufacturers and users.

The proposed date of the convention is satisfactory, as, by that time, many of the manufacturers who are yet in the experimental stage will have decided whether or not they will continue business, and many owners, present or prospective, of motor vehicles who are now out of the city, will have returned.

Very truly yours,
National Motor Carriage Company,
Arthur S. Winslow,
Secretary.

New York, July 15.

PERSONAL.

M. Henri Moissan was elected an honorary member of the German Electro chemical Society at its recent meeting at Göttingen.

Mr. John H. Cahill, secretary of the New York Telephone Company, returned with Mrs. Cahill last week from a brief holiday in France and England, most of which was spent in an historic chateau in Savoy.

Mr. Mark A. Replogle, a well known pioneer in the work of installing and governing water-wheels and the author of the book entitled "Electricity and Water-Power," has associated himself with the Webster, Camp & Lane Machine Company, of Akron, Ohio, who will make a specialty of equipping water-powers fully and economically governed.

Mr. Luther Stieringer, the well known electrical engineer, who has been connected with the illumination of all the large exhibitions and fairs in recent years, has had presented to him by the Electrical Exhibition Company, of New York city, a magnificent gold hunting case repeating watch, containing this inscription: "Presented to Luther Stieringer by the Electrical Exhibition Company in recognition of valuable and gratuitous aid rendered in connection with the electrical exhibition held in New York in May, 1899."

Directors of the Columbus Street Railway Company have voted to grant employés a gratuity equal to four per cent of the wages earned by them since May 1.

An Automobile Inquiry.

To the Editor of Electrical Review:

Will you be good enough to furnish information which will enable me to choose the most serviceable kind of an automobile for private use? I am interested in the subject as a possible purchaser, but after a consideration of several electric, gasoline and other types, I feel that I require a more intimate knowledge than I possess. Thanking you for the courtesy, I am,

Very truly,
Howard E. Lockerman.

Boston, July 15.

[The kind of automobile most likely to give satisfactory service depends entirely upon the work it is to do. If, as we assume, our correspondent desires an automobile for use in the city, or for short trips into the suburbs, then an electromobile is practically the only type worth consideration. If he proposes to make long touring journeys, where he would be away from a region containing suitable charging stations, some of the various forms of steam-propelled vehicle would be best, because water and kerosene oil may be had at any cross-roads. In the city, though, the electric vehicle will be found to be, by all odds, the most desirable, because of the absence of noise, odor and exhaust vapors, and the more perfect control which mark this type—indeed, the electric vehicle is the only one seriously to be considered for city or park use. The gasoline machine is noisy, malodorous and unmanageable. The steam machine has the advantage of being easy to replenish almost anywhere. The electric vehicle alone unites silence, safety and ease of direction with absence of evil smells and not unreasonable cost.—Ed. Electrical Review.]

Who Makes Sparking Plugs for Gas Engines?

The Electrical Review has an inquiry from a reader for the addresses of manufacturers of, or dealers in, sparking plugs for gas engines. We will thank any of our subscribers who may be able to furnish the desired information.

Machines for Grinding Mica Wanted.

A Norwegian manufacturing company writes to the Electrical Review to know whether machines for grinding mica are made in the United States and who sells them. Can any of our readers tell us?

THE SPRAGUE AND STANLEY ELECTRIC COMPANIES UNDER THE SAME MANAGEMENT.

E. H. JOHNSON, FORMERLY VICE-PRESIDENT AND GENERAL MANAGER OF THE SPRAGUE ELECTRIC COMPANY, RETIRES TO LOOK AFTER HIS EUROPEAN INTERESTS, AND JOHN E. SEARLES SUCCEEDS HIM AS VICE-PRESIDENT AND HENRY HINE AS GENERAL MANAGER.

The sale of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., as briefly announced in the Electrical Review last week, has been confirmed. The purchasers are a syndicate of New York gentlemen, headed by John E Searles, all of whom are identified with the Sprague Electric Company, in which John W. Mackey, John E. Searles and A. B. Chandler are largely interested. Henry Hine, the general manager of the Stanley company, has accepted the position of general manager of the Sprague company, and took charge of the affairs of the company on Thursday of last week. While no definite plan has been decided upon, it is generally understood that the two companies will gradually amalgamate, and the union will be one of undoubted strength and of particular electrical importance and value.

The officers of the Sprague Electric Company are A. B. Chandler, president; John E. Searles, vice-president; Henry Hine, general manager, and Lieut. Frank J. Sprague, electrician.

E. H. Johnson, who recently resigned as vice-president and general manager of the Sprague company, is in England looking after his interests in that country. Mr. Johnson was one of the organizers of the Sprague company and had been very active in its management until called abroad by important developments.

The history of the Stanley company is one of much interest. The company was organized at Pittsfield, Mass., some eight or nine years ago, by Henry Hine and W. Stanley, Jr., and others, and started in business with a capital of $25,000 and a staff of 16 employés. When the recent sale was made the capital of the company was $500,000, about $420,000 of which had been issued, and each stockholder received $150 per share. Orders amounting to about $350,000 were turned over to the syndicate making the purchase. The company achieved a unique and pronounced success, which reflects the greatest credit on Henry Hine, its general manager from its organization, as well as on the excellent work of W. Stanley, Jr., the inventor of the system.

BOOK REVIEWS.

"Liquid Air." By T. O'Conor Sloane, Ph.D. New York: Norman W. Henley & Company. 1899.

This book consists of several hundred pages of good white paper that deserved a better fate.

"Telephones — Their Construction and Fitting." By F. C. Allsop. Spon & Chamberlain, New York.

An admirable treatise, very fully illustrated. It is, for the most part, confined to description of British practice, but on this account is full of interest for the American reader, who may gain ideas of value from seeing how things are done on the other side.

"Municipal Public Service Industries." By Allen Ripley Foote. The Other Side Publishing Company, Chicago.

A general discussion of the problems involved in municipal and corporate ownership of public service works. The system proposed gives full application to the best features found in propositions made by municipal ownership advocates, and also by those who urge the advantages of private ownership and operation. It is an interesting and unprejudiced discussion.

LITERARY.

"Richard Carvel" is in its seventh edition. In other words, this means that since the week of its publication it has been sold at the rate of close upon 1,000 copies a day.

The color printing of the fiction number of *Scribner's* will be shown in Maxfield Parrish's cover, in a frontispiece by Glackens to accompany a poem by E. S. Martin, and in a short story of a little Italian theater in New York, the pictures also by Mr. Glackens.

With its infinite variety of excellencies, the July *Ladies' Home Journal* appeals to every taste and touches upon every interest. It opens with "The Most Famous Little Town in America," which pictures many interesting spots in historic and literary Concord. There is a delightful view of social life in the Colonial days in "When Washington was Married," which brings to light many new, interesting facts.

In commenting upon the action of Harvard in bestowing the degree of LL. D. upon Professor Hadley, the new president of Yale, *Literature* urges that now that the ice has been broken this interchange of courtesies should be continued. In this event, the writer humorously suggests the possibility of our one day seeing a Harvard man elected captain of a Yale crew, and a Yale pitcher in the box for the crimson nine.

President Hadley is congratulated on his new honor, which puts him in the enviable position of being able to cheer, no matter which side wins.

In Philadelphia, the Curtis Publishing Company have lately rehabilitated the oldest publication of its kind in America—*The Saturday Evening Post*, which was founded by Benjamin Franklin in 1728. The journal is a weekly, which occupies itself with a certain class of fiction, short stories, little essays on current events, etc., and has already attained a very large circulation. Among its most noticeable features are the excellent illustrations, which are representative of the best American work in black and white. Among the contributors appear the names of most of the distinguished literati of this country, while the typography and general appearance of the paper are such as to commend it at once to the discerning reader. It is to be hoped that this, the oldest paper, may also become in a little while the newest success.

Long Spans of Overhead Wire.

To the Editor of Electrical Review:

I have noticed in some recent issues of your paper, communications regarding long overhead spans of wire. I will say that we have now across the Ohio River, between Cannelton and Hawesville, a span of single wire about 2,600 feet long, and across the Ohio River at Rockport, Ind., a double span, each wire of which is in the neighborhood of 3,300 feet long.

Yours truly,

W. K. Boardman, Mgr.,
Cumberland Telephone and Telegraph Company.

Owensboro, Ky., July 10.

A Large Turbine Contract.

The Webster, Camp & Lane Machine Company, of Akron, Ohio, have received from the Michigan Lake Superior Power Company, of Sault Ste. Marie, Mich., what is said to be the largest contract for turbines, as regards the number of wheels, that has ever been let. When finished the company's power-house will contain 320 water-wheels of the "Jolly-McCormick" type. The power company has exacted unusually high speed, efficiency and power for these wheels.

An Old Saw Up to Date.

Never look a gift automobile in the works.—*Chicago Record.*

DESCRIPTION OF THE ELECTRIC TRAIN STAFF AND ITS OPERATION ON C. N. O. & T. P. RY.

READ BEFORE THE CENTRAL ASSOCIATION OF RAILROAD OFFICERS, ST. LOUIS, JULY 18, 1899, BY W. J. MURPHY.

The staff is a steel pipe 22 inches in length, on the end of which is stamped the names of the two points which bound the limits of the block.

The staff performs two duties: first, it is a key with which to unlock the levers which operate the semaphore blades, so as to permit the semaphore signals to be set to a vertical or safety position for trains to proceed (these signals can not be set to the safety position without first being unlocked by the train staff). Second, it takes the place of, and has the same effect as, a written train order, inasmuch as the possession of a train staff by the engineman or conductor, or both, gives to them the absolute right of track through the block over all trains.

Only one staff can be taken from the machine at a time. When the staff has been withdrawn from one machine another can not be withdrawn from either until the staff previously removed has been placed in the same machine, or in the machine at the opposite end of the block.

The staff machines at both ends of the block are electrically connected together. When it is necessary to take a staff from one of the machines the operator at the opposite end of the block must be signaled to unlock the machine so that the staff can be taken out.

When a train is ready to proceed south, for example, the staff operator at the north end of the block will signal the staff operator at the south end of the block by pressing down twice the bell lever on right side of the staff machine. The operator at the south end of the block will acknowledge this call by pressing down twice the bell lever on his staff machine. The operator at the north end of the block will then give the bell signal to unlock his machine and immediately turn the right-hand indicator to the position "For Staff." The operator at the south end of the block, on hearing the bell signal, will immediately press down his bell lever and hold it in this position until the needle of the indicator ceases to vibrate, which will be evidence to him that the staff is out. He will then turn the left-hand indicator to the position "North Staff Out." When the staff has been released from the machine the operator at the north end of the block will turn his left-hand indicator to the position "North Staff Out." The staff must then be inserted in the lock of lever machine and turned to the right; this releases the levers of the signal governing the track to be used, and permits the signal to be thrown to the safety position. When the signal has been set at safety the staff should be turned sharply to the left and withdrawn from the lock, and then be delivered to the train desiring to proceed.

Light engines are given the full staff; passenger, freight and work trains are given the divided staff; that is, half of the staff is given to the engineman and the other half to the conductor of the train. The staff thus given to trains must be delivered by the enginemen and conductors to the operator at the opposite end of the block on arrival there, and the staff must then be put into the machine immediately and the bell signal given to the operator at the opposite end of the block that the train has passed out of the block.

The permissive attachment is used when more than one engine, freight or work train going in the same direction desire to use the block, and then only by special permit from the superintendent in each case.

The permissive attachment is never used for passenger trains.

There is but one permissive staff and six tablets (tablets are cast-iron, six inches long, two inches wide and one-fourth-inch thick).

When necessary to use the permissive attachment the permissive staff is released in the same manner as the ordinary staff and inserted into the permissive lock on the right of the staff machine and the tablet case unlocked. The staff is then used to unlock the lever machine so as to permit the semaphore signal to be set safely for trains to proceed.

A tablet is then given to the engineman of each section, and the engineman of the last section (if it be a light engine) receives all the remaining tablets and the staff chained together; but if it be a train, the engineman receives the remaining tablets chained together and the conductor the staff. When the operator at the opposite end of the block, after the arrival of the trains, has received all the tablets and the permissive staff, he must unlock the tablet case with the staff and place the tablets therein. The staff must then be put in the staff machine and the bell signal given that "train has passed out of the block."

Until the permissive staff and all of

the tablets have been placed in one of the machines, no staff can be withdrawn from either machine.

In all cases the semaphore signal must be thrown to the danger position when the rear engine or the rear car of the last train has passed 150 feet into the block, and the operator will immediately signal the staff station in advance that the train has passed into the block. The operator is required to promptly signal the entrance of trains into the block, in order to insure the setting of the semaphore signal to danger, as he can not always be kept at danger, except when necessary to change to safety to permit trains to proceed. For trains to proceed, the signal must be in the safety position, and in addition to the signal to proceed, no train must be permitted to leave a staff station without being in possession of the staff or a tablet. All trains must approach staff station under full control, prepared to stop if the signal is against them.

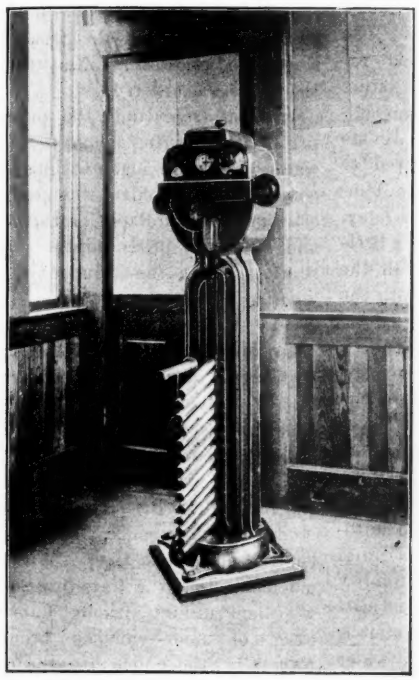
The engineman and conductor of a train are the only persons authorized to receive a train staff or tablet from the staff operator, who must personally hand them to the engineman and conductor. On arrival at the opposite end of the block the engineman and conductor must promptly deliver the staff or tablets to the staff operator, but the operator must never receive a staff from the conductor of a train until the last car has passed the signal or is clear of the block station. In case a train parts, or it is necessary to double, the train staff or tablets must be retained by the engineman and conductor until all of the train is clear of the block.

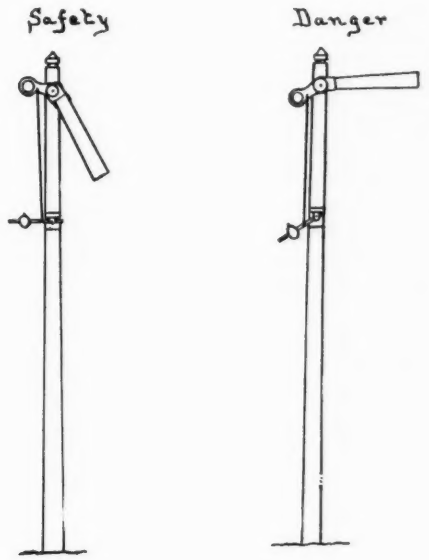
Under no circumstances will a staff or tablet be transferred from one train to another. They must be delivered to the operator and the operator must pass them through the instrument in strict compliance with the rules.

In case of failure of the staff apparatus, trains will be moved by the train dispatcher, who will, before issuing any train orders over the territory covered by the electric staff, ascertain beyond the possibility of a doubt that the block is entirely clear, and that all the staffs at both ends of the block (31 in number, including the permissive) are in the staff machines.

When an order is to be transmitted for movement of trains in the electric staff limits, signal 27, meaning staff telegraphic train order, will be given to staff offices, followed by the word copy and the figure indicating the number of copies to be made, and all the requirements of a 31 order, as per General Rules 509 and 510, will apply to the 27 order.

When the staff apparatus is repaired and ready for operation the train dispatcher, after he has ascertained positively that the last train moved by a 27 order has arrived at the staff station to which it was authorized to proceed, will then direct the staff operators at both stations that the trains may proceed in accordance with the staff rules.





Staff Semaphore Signals.

DETAILS OF THE ELECTRIC STAFF RAILWAY SIGNAL SYSTEM.

signal the entrance of the train into the block with the signal in the safety position for the reason that the safety position of the signal breaks the circuit, and the circuit can only be restored by the signal being set to danger.

CODE OF BELL SIGNALS FOR ELECTRIC TRAIN STAFF.

To attract attention—two taps, thus.....	- -
Unlock my machine—three taps, thus.....	- - -
Wait, can not unlock now—four taps, thus.	- - - -
Train has passed into block—two taps, two taps, two taps, thus..	- - - - - -
Train has passed out of block—two taps, two taps, two taps, one tap, thus	- - - - - - - - -
Testing staff bell—eight taps, thus.....	- - - - - - - -

GENERAL RULES.

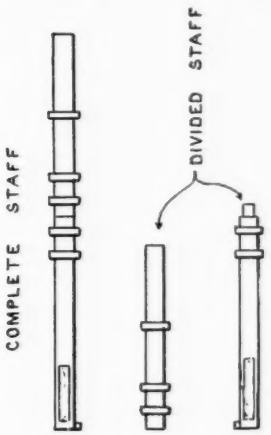
Semaphore signals in connection with the operation of the staff must

Aluminum and the Reduction of Initial Loads.

The weight of large bridges and large machines is a constant load which must be initially deducted from their possible efficiency. A large iron bridge on another planet, where the force of gravity is less, would be able to carry greater loads than on the earth, because it would have a less initial load, and more strength to maintain live loads. It was thought that the electrically produced metal aluminum would provide the engineer with a metal which would possess virtues equivalent to a vast reduction of the force of gravity and the effects of initial loads. In consequence the projected applications of this metal have been great. The latest will bring comfort and ease in working to railroad workers. An aluminum hand-car is being built by the St. Louis Aluminum Casting Company. The wheels, body and working beam will be of aluminum, and the axles of steel tubing. It will not weigh more than 150 pounds, and one man will be able to lift it on to the track, and two men will be able to drive it at the rate of 30 to 35 miles an hour for a short time.

Electric Traction in London.

After several years of contest for the adoption of the overhead system of electricity on its tramways within the district of the London County Council, the London United Tramways Company has at length succeeded. Last year the company obtained these powers for all its lines in the County of Middlesex and recently the bill to authorize the overhead system within the County of London passed the House of Commons unopposed. As part of the arrangement with the London County Council the company has agreed to lay a short piece of underground system between Hammersmith-broadway and Young's-corner, Chiswick; but on the two lines which converge on the terminus of the Central London Electric Railway, and, indeed, on the whole of the company's main lines, the overhead system will be used. The process of construction is proceeding rapidly, and now that the only obstacle is removed, the whole of the United Company's system will be operated by electricity. The existing lines have been reconstructed, and some miles of the extensions from Kew Bridge to Brentford and Hounslow are already laid, so that the opening of the first electric tramways in London will be completed at an early date.



Wall Street and the Electrical Stock Market.

The bank statement for the current week showed that the associated banks had reached a point where their loaning power had been fully extended, and that it was necessary for them to contract their credits. The close money market of the week shows that the banks have been following the latter course. At the same time no especially stringent financial strain prevailed. Prior to the publication of the bank statement to-day the market was virtually at a standstill, although a sharp advance followed.

On the New York Stock Exchange General Electric closed the week at 118⅜ bid and 119 asked, a gain of ½ a point for the week. Metropolitan Street Railway, of New York, closed at 222¼ bid and 222½ asked, a loss of 2½ points for the week. Third Avenue Railroad, of New York, closed at 187 bid and 190 asked, indicating no change in the asked price for the week.

On the Boston exchange American Bell Telephone closed at 344 bid and 345 asked, a loss of 3 points for the week.

On the Philadelphia exchange Electric Storage Battery common closed at 159 bid and 160 asked, a gain of 15 points for the week. Union Traction closed at 41¾ bid and 42 asked, a loss of ⅜ of a point for the week.

On the curb or outside market in New York Electric Vehicle closed at 101 bid and 103 asked, a loss of 8 points for the week. Electric Boat closed at 10 bid and 17 asked, a loss of 3 points for the week.

Wall Street, July 15.

Another Telephone Rumor Denied.

It was reported in financial circles on Monday of this week that a combination would be effected between the American Bell Telephone Company and the American Telephone and Telegraph Company, which controls the long-distance telephone service of the country, and that the headquarters of the American Bell Telephone Company would be removed to New York. A prominent telephone official, who is in a position to know the truth of the matter, denied the report. Another prominent telephone man explained that such an arrangement would be impossible in view of the facts in the case. The American Bell Telephone Company is and has been the owner of the American Telephone and Telegraph Company. At the present price of American Bell stock, which is around 345 to 350, it would be impossible for the American Telephone and Telegraph Company, with its authorized capital of $75,000,000, to purchase the American Bell company, capitalized at about $30,000,000, even if the former was a free agent and had the power to make the purchase.

One More Rumor Denied.

We are authorized to deny the statement that has appeared in the daily press that the General Electric Company intends to actively begin the manufacture of automobiles at its factory at Lynn, Mass. The further statement that the company intended to move its factories from Schenectady to Lynn is entirely incorrect and has never been contemplated.

At a recent meeting of the Electric Light Company, of Johnstown, N.Y., the following officers were elected: President, R. A. C. Smith; secretary, H. G. Runkle; treasurer, A. M. Young. Mr. Young is a former Johnstownian, and his brother, Dr. J. K. Young, resides there.

A newspaper cablegram from Vienna states that military engineers who have experimented with the Marconi system of wireless telegraphy, using balloons, one captive and the other free, report that the results were satisfactory enough to justify further experiments. The signals were clearly transmitted for a considerable time, but were sometimes interrupted afterward.

The New England Telephone and Telegraph Company has acquired all of the $600,000 capital stock of the Southern Massachusetts Telephone Company, on the basis of four shares of New England stock for three shares of Southern Massachusetts. The Southern Massachusetts company has operated as a licensee of the American Bell Telephone Company in the five southern counties of Massachusetts, and has about 4,000 exchange subscribers and an extended system of toll-lines through the larger part of its territory. The company has paid eight per cent dividend for several years, while the New England Company has paid at the rate of six per cent. The following have been elected directors: Chas. F. Ayer, Moses G. Parker, Samuel Ivers, Chas. W. Clifford, John E. Hudson, Jasper N. Keller and Thos. Sherwin.

Sea Breezes on Tap.

The cooling machine alluded to in a recent issue as having been devised by Dr. Louis Bell has recently been placed on exhibition at 100 Broadway, New York city, and affords a good example of neatly applied thermodynamics. As the ELECTRICAL REVIEW then mentioned, it is intended purely for air cooling, and depends on utilizing the great latent heat of evaporization of water, thereby being widely different in principle from the refrigerating machines now in use, which convert mechanical energy into heat, abstracted through the medium of liquefied gases. The Bell machine is not intended for heavy refrigerative work, but is designed for cooling at maximum efficiency over the range of 10 to 25 degrees Fahrenheit, required to keep a room at comfortable temperature on a hot Summer day. The only power required is for a little electric motor blower to furnish the forced blast, which provides both the air circulation and the chilling effect. The water used is distributed in a capillary film and evaporated so energetically that 100 watts delivered to the motor is sufficient to send out of the apparatus about 10,000 cubic feet of air per hour, cooled to about 68 degrees Fahrenheit. The air delivered is held near this temperature automatically, and itself remains quite dry or at such a degree of humidity as may be provided for in the adjustment of the apparatus. Water is ordinarily taken from the local water supply, and current from the nearest available source. In its portable form the machine may be readily set up for use in sick rooms or hospitals, where such an appliance is often much needed. In this sort of work, and indeed for all cases where cool air is required, it is far more efficient than ordinary refrigerating apparatus, and, moreover, requires no more attention than a common fan motor.

The Boston, Revere Beach & Lynn, Mass., Railroad carried about 50,000 passengers on July 1, which is a record, although the company carried about as many passengers on Labor Day last year. General Manager Fenno says: "It is too early to make any prediction as to the success of the five-cent fare on our road. We are carrying a largely increased number of passengers, and it looks as though our earnings would run as high as they did before the cut in fares. Of course we can not tell as yet what we will do in Winter, and it is hardly fair to take a hot week to make a comparison. All I can say is that the outlook is very favorable."

The Street Railway Strike in Brooklyn, N. Y.

The Knights of Labor, at 1.45 A. M., on Sunday, July 16, voted to call out the members of its organization employed on the Brooklyn, N. Y., Rapid Transit Railroad system at 4.30 that morning. Previously a committee had waited upon President Rossiter, of the company, and presented certain demands regarding an increase of wages and a rearrangement of the time-tables of the various roads composing the system. Mr. Rossiter showed them that, except in minor particulars, all that they asked for they already possessed. Nevertheless, the strike was ordered.

It is asserted that the principal reason for bringing about the strike was due to the machinations of a coterie of stockholders who are interested in Brooklyn Rapid Transit stock, and that they produced the present result through the influence of paid labor agitators.

The strikers endeavored to tie-up one or more of the lines of the Brooklyn Rapid Transit system, but signally failed in every instance. Chief of Police Devery, of New York city, promptly sent from the Borough of Manhattan about 1,400 policemen to the Borough of Brooklyn. These included mounted police, patrolmen and central office detectives. With this efficient aid all the lines in Brooklyn were kept running, although numerous cases of mob violence occurred. Naturally, the police had the upper hand, and there are many of the strikers in jail and numerous others with broken heads. It was found that the mounted police were especially efficient in dispersing mobs by charging upon them with drawn clubs.

A test car, sent out over one of the lines in charge of Chief Engineer J. C. Brackenridge, was assaulted by the strikers and the motorman was stoned. Several detectives and policemen aboard the car charged upon the mob, and, with the help of Mr. Brackenridge and two or three other officials of the road, captured five of the strikers who were taken aboard the car, and later lodged in jail.

President Rossiter addressed numerous meetings of the strikers, and assured them of his intent as president of the company to treat them with all fairness, and requested the men to return to work. At the time this issue of the ELECTRICAL REVIEW goes to press it looks as if the strike would be declared off, as the backbone of it seems to be broken.

The Royal Institution.*

The celebration of the centenary of the Royal Institution, London, which took place recently, is an event of interest and importance to scientific men, emphasized to us, perhaps, by the fact that the founder of the Institution was an American. It is a somewhat curious fact that the Smithsonian Institution should have been founded by an Englishman and the Royal Institution by an American. There has not been time for an account of the exercises in connection with the celebration to reach us, but, according to the programme, they were to include a lecture by Lord Rayleigh on the physical work of the Institution during its 100 years' existence and a lecture by Professor Dewar on its chemical work. The attendance of a large number of foreign delegates had been assured. In the meanwhile, we take from the London *Times* the following facts regarding the history and scope of the Institution.

It was founded by Sir Benjamin Thompson, or, as he preferred to call himself, Count Rumford in the Holy Roman Empire, and was an offshoot or extension of a society for bettering the condition and increasing the comforts of the poor, formed in 1796, according to the proposals of that somewhat eccentric genius. His ideas on the matter were formally submitted to a select committee of that society, which reported in their favor on February 1, 1799. The next step was to circulate a definite outline of the scheme among people who were thought likely to subscribe to the undertaking, and so successful was their appeal to the public that 58 of the "most respectable names" were obtained in a few weeks. On March 7 these original subscribers of 50 guineas each met at the house of Sir Joseph Banks, then president of the Royal Society, and elected a committee of managers, who were desired to take preparatory measures for opening the Institution, and in particular to solicit the king for the grant of a royal charter, which was obtained early the next year. Less than two months later the purchase was ordered of Mr. Mellish's house, in Albemarle street, and on June 5 the managers held their first meeting on the premises, which have ever since remained the home of the Royal Institution.

This, as may easily be inferred from the circumstances of its origin, was in the conception of Rumford a very different style of place from what it subsequently became. It was, in fact, nothing but a glorified mechanics' institute, its objects being, as defined in his proposals, the speedy and general diffusion of the knowledge of all new and useful improvements, and teaching the application of scientific discoveries to the improvement of arts and manufactures and to the increase of domestic comfort and convenience. The first was to be attained by the public exhibition, preferably in actual operation, of useful inventions applicable to the common purposes of life. A perusal of the detailed measures by which this end was to be achieved almost makes the reader suspect that in the Count's view salvation was to come by cooking. His list of the things to be shown in the repositories, indeed, includes models of "that most curious and most useful machine, the steam engine," of ventilators, limekilns, spinning wheels and looms, agricultural implements, bridges of various construction, etc, but the place of honor is given to stoves of all sorts and to the "most perfect models of the full size" of kitchens and utensils suitable for a cottage, a farm-house and the family of a gentleman of fortune, respectively. The Institution, too, had not been in existence for a year when a good cook was engaged for the "improvement of culinary advancement, one object and not the least important for the Royal Institution," while another of Rumford's pet projects was the establishment of a dining-room in the house where experimental dinners could be ordered, to test the merit of any new method of cooking or any new dish that may be proposed. To attain the second of the primary objects of the Institution, Rumford proposed to fit up a lecture-room for philosophical lectures and experiments, and to provide a complete laboratory and philosophical apparatus for making chemical and other experiments. Only men of the first eminence in science were to be invited to "officiate in the most important and distinguished situation of lecturers," and, to judge from the prospectus, they were to confine themselves to the most severely practical applications of science.

For the first two or three years Rumford devoted all his energy to the realization of his ideas, and it is evident enough that during that time he was the ruling spirit of the Institution. The first part of his scheme to be brought into operation was the course of philosophical lectures. These were begun in March, 1800, Dr. Garnett being the first professor. For a time a temporary lecture-room was used, but it was not long before the theater, built from the designs of Webster, was brought into occupation. This room, which is singularly successful in its acoustic properties, remains substantially unaltered at the present day, the chief structural changes being the abolition of a stone staircase that led directly from the upper gallery to the street, and the improved exit, which was finished only a month or two ago. The only other important event in the first year of the Institution's existence was the appointment of 14 committees for the purpose of specific scientific investigations; but that the managers had not the least idea of promoting what we should now call original research in pure science is obvious from the subjects into which they were to inquire. Rumford's hand is plainly discernible in the list, which includes bread, soup, cottages, stoves, household furniture, food for cattle, mortar and cement, fireballs and combustible cakes, etc. In the next two years still greater progress was made. The chemical laboratory was brought into use, and a director, operator and assistant were appointed; the workshops, in which models of new and useful inventions were to be constructed and sold at reasonable prices to subscribers and professors, were finished and provided with the best tools obtainable; a number of skilled mechanics were engaged, and arrangements were made for the reception of ingenious and well-behaved young men, who were to be boarded in the house, working in the workshops by day and in the evening attending classes in drawing, practical geometry and mathematics, under the direction of the clerk of the works, Mr. Webster.

But in 1802 a change began to make itself felt. Doubtless the circumstances that personal reasons caused Rumford to leave England and relinquish the superintendence of the Institution was not without influence, but the main factor was want of money. Rumford was perhaps justified in writing early in 1801 that the Institution was "not only the fashion, but the rage;" but in 1802 the case was certainly different. In 1799 the income was £6,379 and in 1800 £11,047, but in 1801 it fell to £3,474 and in 1802 to £2,999, while at the same time the expenses were increasing. In short, the state of affairs became so bad that the idea was seriously discussed of closing the place and selling off its property to pay its debts. Luckily, however, it was saved, and the management passed into the hands of men stigmatized by Sir Joseph Banks as "the enemy" and "the profane," which was, perhaps, his way of saying that they possessed some business-like instincts. Quietly dropping the kitchens, the models, the workshops and the school for mechanics, in which Rumford's interest had centered, they determined to carry on the scientific establishment and to get money for so doing by giving "fashion to science." This policy may not have been magnificent, but it was successful, and has resulted in securing to the Royal Institution a place in the history of scientific progress which all the patent stoves and roasters in the world would never have assured. Nor, after all, was there anything very dreadful about it. The private patron of science or art is not despised because his liberality has afforded some struggling genius the opportunity of using his talents; why, then, should an institution have been abused because it set itself to organize the public into a sort of collective patron?

The domestic record of the Royal Institution from the time when, in Davy's words, it definitely took the "form of a body for promoting experimental science, and for diffusing every species of philosophical knowledge" contains few events of surpassing interest. Financial crisis have been not infrequent, and sometimes acute, but have never proved fatal. Increased prosperity was hoped for as a result of the modification of its constitution by Act of Parliament in 1810, but its first endowment, some 23 years later, was none the less welcome. This consisted of a sum of £10,000 from John Fuller, and rumor says that it was a token of gratitude because the lecture theater of the Institution was the only place where he could overcome the insomnia from which he habitually suffered. With two-thirds of the money professorships of chemistry and physiology were to be endowed, while the remaining portion went to form an accumulating fund, the interest on which, when the capital amounted to £10,000, was to be applied to the general purposes of the Institution. Since then it has received many legacies and donations. Money left by Mr. Alfred Davis in 1870 enabled the chemical laboratory to be rebuilt in accordance with modern requirements; in 1892 Mr. T. G. Hodgkins, of Setauket, Long Island, gave $100,000 for the "investigation of the relations and co-relations existing between man and his Creator"; and in 1896 Dr. Ludwig Mond founded and endowed the Davy–Faraday Research Laboratory, which is contiguous to the Royal Institution and under the superintendence of its managers. This is specially interesting as being in great measure the realization of a scheme which the Institution all but adopted more than half a century before. In 1843 a proposal was made to establish on its premises a school of chemistry, not only to give instruction to students, but to provide a place where original research could be carried on by skilled workers. The scheme met with cordial approval from Faraday and the managers of the Institution, and they only abandoned it because they were reluctantly driven to the conclusion that the accommodation was not sufficient to carry it out properly. Since that time schools of chemistry have been started in abundance, but no place designed exclusively for the prosecution of independent research existed in England until Dr. Mond's liberality provided this laboratory, which is open to qualified workers without distinction of sex or nationality.

The real history of the Royal Institution is the history of the discoveries made by the distinguished men who have worked in its laboratories, and to write that in full, at least for the early part of this century, would be little less than writing the history of scientific progress in England. The Institution had the good fortune to secure among its first professors three of the greatest natural philosophers this century has known. The first, Thomas Young, was a man of the most remarkable and varied attainments, but, perhaps, his best title to fame is that he was one of the prime founders of the wave theory of light, which

*From *Science*.

plays so important a part in modern physics. It was left to later generations to appreciate his merits in this respect and to discover that he had anticipated many points for which Fresnel was given the credit. Sir Humphry Davy's tenure of the professorship was nearly coextensive with his scientific life. Engaged in 1801, he immediately proved himself not only a lecturer of singular charm, but a most skillful and prolific investigator. His most far-reaching researches were probably those on the chemical agencies of electricity, for it was in the course of them that he decomposed the alkalies by a strong electrical current, thus not only discovering the metals sodium and potassium, but laying the foundations of electrolytic chemistry, a science whose industrial applications are now becoming more numerous and important every day. In addition, he made many researches in pure chemistry, and his work in the philosophy of flame led to the famous invention of the miner's safety lamp. The third of this triumvirate, Michael Faraday, entered the service of the Institution as assistant in the laboratory and rose to be its chief ornament and support. His scientific output during the 50 years in which he labored is quite unequaled for range and quality, including, as it does, researches in alloys, new organic compounds, optical glass, the liquefaction of gases, regelation, the action of metals on light, magnetism and diamagnetism, the magnetization of light, and the induction of electrical currents. The place of honor must undoubtedly be assigned to his work in the last department, not only because of its enormous theoretical significance, but also on account of the practical results of which it has been the starting point; it forms the foundation of the huge and increasing fabric of modern electrical engineering.

Another distinguished name in the annals of the Royal Institution is that of John Tyndall, who for 34 years maintained the traditions of the place as a brilliant lecturer and experimentalist. His researches were numerous and varied, the main ones relating to heat, to sound and to the behavior of small particles, such as compose dust, whether of living or dead matter. Of the first the difficult investigation of the absorption by gaseous bodies of invisible radiation is the most important, but his book on "Heat Considered as a Mode of Motion" is a classic which shows to advantage his splendid power of popular scientific exposition. In sound some of his most interesting work, that on the laws governing the audibility of foghorns and other signals in thick weather, was done as scientific adviser to the Trinity Board, a position in which he succeeded his friend and colleague Faraday, while his inquiries on atmospheric dust yielded results of great value alike to the physicist and the biologist. Tyndall was succeeded, both at the Royal Institution and the Trinity House, by Lord Rayleigh, who is universally recognized as one of the ablest mathematical physicists now living. Doubtless, he is best known popularly in connection with the discovery of argon, but, in fact, his scientific reputation rests upon investigations of the most abstruse and difficult kind and upon practical achievements, among which the isolation of a new gas takes a secondary place. Of the men who followed Faraday in the chair of chemistry all are still at work. The first, Sir Edward Franklin, perhaps, in strictness should not be called a successor of Faraday, since he never held the Fullerian professorship, which was bestowed on Faraday for life, but he was appointed professor of chemistry when the latter's failing health obliged him to give up lecturing, and in the laboratory of the Royal Institution he carried out some of those researches on organo-metallic compounds which stamped him as one of the most remarkable experimentalists of the time. The next two Fullerian professors were Dr. Odling and Dr. Gladstone, and the fourth was Professor Dewar, the present occupier of the chair, who was appointed in 1877. Continuing the work initiated by Faraday on the liquefaction of gases, he has succeeded in proving by experiment that, as indicated by theory, there is no such thing as a "permanent gas;" for, since his recent liquefaction of fluorine, helium and hydrogen, no known gas remains that has not been reduced to the liquid state. His work has opened up an entirely fresh field of physical research, and, rich as the first results have been so far, they are in all probability only small in comparison with those which will be obtained by further investigation of the properties of matter near the zero of absolute temperature.

The Institution has undoubtedly been fortunate in the professors who have worked in its laboratories. But even genius can not do much without opportunity, and, therefore, some of the credit is deserved by the long succession of officers and members of the committee of managers, who have for 100 years looked after its business affairs and guided it safely through many vicissitudes, not only without fee or emolument, but at the expense of much time, and, not infrequently, of much money. In this connection, it is interesting to note that the presidency almost seems to have become an hereditary appanage of the Dukes of Northumberland, for, with the exception of the years between 1865 and 1873, when it was held by Sir Henry Holland, it has been in their hands continuously since 1842. Mention, too, must be made of what the members themselves have done. Over and above their regular subscriptions, they, with their friends, have contributed since 1863 something like £13,000 to the fund for the promotion of experimental research, and it is safe to say that had it not been for this fund English science in general would have been the poorer, and the Royal Institution in particular would not possess the international reputation it bears to-day—a reputation won, be it remembered, in the good old English way, without state subvention or government aid. Modern scientific research daily becomes more costly, because apparatus grows in delicacy and complication, on the one hand, and in size and weight, on the other, and thus there arises a proportionate increase in the need for individual generosity. The fact that such pecuniary aid has been forthcoming in the last century warrants the expectation that the stream of benefactors to the Royal Institution will not fail in the next, and that they will enable it to point to as proud a record on its second centenary as it now does on its first.

Engines for the New York Elevated Railway Electric Plant.

The Manhattan Railway Company, of New York city, has begun active operations toward the electrical equipment of the elevated railroads. The power-house site recently purchased by the company, between Seventy-fourth and Seventy-fifth streets on the East River, is being cleared, and the erection of the power-house will be commenced at once.

The Manhattan Railway Company last week placed an order for nearly $1,000,000 worth of steam engines for the new plant with Mr. F. A. Larkin, New York manager for the E. P. Allis Company, of Milwaukee. The order calls for eight engines of 8,000 horse-power nominal capacity and 12,000 horse-power actual capacity. They will be of the compound condensing, vertical type, designed to be direct-coupled to electric generators of 5,000 kilowatts capacity each. It is expected that these engines will be built, delivered and erected within a year.

General Superintendent W. E. Baker, of the Manhattan Railway Company, informs the ELECTRICAL REVIEW that the company has decided upon the plans for the generators, but has not as yet called for bids on their construction. The contract for the boilers to be used in the new power station has not been awarded.

The Production of Copper in the United States.

The production of copper in the United States in 1898, as reported by the United States Geological Survey, was 526,375,591 pounds, which is by far the largest product ever reported. The year, says the report, was one of general prosperity for the copper mining industry, the full product being marketed at prices slightly better than those of 1897. The actual scarcity of copper, with its accompanying upward rush in price and its enormous expansion of stock speculation, did not in reality develop until the end of the year and it did not tell upon the returns. As was expected, the increase in the production of copper was largest in Arizona, while the lake district also recorded an advance. Montana fell off considerably.

Intense activity has developed in the search for new copper mines, and a large number of new undertakings have started. But the preparations for output on even a moderate scale in the way of opening mining property and providing a reduction plant are so large and require so much time, that few of the newcomers will add materially to the copper market of 1899. What increase there will be will come from the older mines, and that chiefly from Arizona, the Lakes, California and Utah.

ELECTRIC RAILWAY NOTES.

The St. Paul, Minn., Union Depot Company will install an electric system of switching in its yards, to accommodate the increase of business. The plant will cost about $30,000.

In consequence of the refusal of the Camden & Suburban Railway Company, of Camden, N. J., to pay a license fee of $25 per car, Mayor Hatch threatens to tie up the lines of the company.

The Columbus, Winchester & Lancaster Traction Company is seeking for a franchise to build an electric line from Columbus to Lancaster, Ohio. The undertaking is said to be backed by Hocking Valley bondholders, the object being to shut out another company which is being organized to build a road between these points.

It is said that a company recently incorporated to construct electric suburban lines between Indiana cities will begin with a line from Terre Haute to Brazil, 16 miles. Stone & Webster, of Boston, are said to be prime movers in this company, known as the Indianapolis, Plainfield & Western Rapid Transit Company, and capitalized at $100,000.

The Chicago & Milwaukee Electric Railway Company has had recorded a mortgage covering its road for $1,500,000. It was given to the Cleveland Trust Company and Royal Trust Company to cover funds secured to extend its line from Highland Park to Evanston, Ill. When the extension is completed work will be begun in double tracking the older part of the line from Highland Park to Waukegan. It also is contemplated to extend the line for local services. Franchises for these extensions will soon be asked for.

Electric Traction in Marseilles.

United States Consul Robert P. Skinner writes from Marseilles, France, as follows:

"Several inquiries have recently been sent to the consulate at Marseilles concerning passenger transit, concessions, rates of fare, and possibilities open to investors. In reply to these, and for the benefit of the public, it may be said that shortly before the writer took charge of this post a convention was concluded between the city and the Compagnie Générale Française de Tramways, of Paris, whereby the latter secured a concession for the principal streets of the municipality. The concessionaires are now revolutionizing the traction system of the city, and in the course of the year, electric motors will be in operation on every important thoroughfare.

"Until the present time, Marseilles has had an inadequate service of horse cars and omnibuses. Under the new order of things many of the omnibus lines will continue, for a time at least, but the horse cars will be retired. The concession will expire on December 31, 1950, and, as required by French practice, it has been ratified by both the city and the state. The system of traction is known here as the Dickinson overhead trolley. The company is obliged to replace in perfect order, and to pave when necessary, the surface of the streets disturbed between tracks, including the space between double tracks, and an additional strip 35 centimetres (14 inches) wide along each outside rail.

"At the present time, the fares on various lines are regulated by distance. In the heart of the city, the usual fare is 10 centimes (two cents), and for longer rides as much as 40 centimes. When the electric lines are installed, the uniform fare of 10 centimes only will be charged. To the city, the company will pay an annual fee of 100,000 francs ($19,300) for the use of the streets, and when the gross receipts for a year aggregate 7,000,000 francs, a supplementary fee will be paid as follows: For the eighth million, 40,000 francs ($7,720); for the ninth million, 50,000 francs ($9,650); for the tenth million, 60,000 francs ($11,580), and for every million over 10, 60,000 francs.

"Electric trains will not be composed of more than four cars. The length of the train must not be over 36 metres (118 feet), and the speed must not exceed 20 kilometres (12.42 miles) per hour.

"Upon the expiration of the concession, the state will become the owner of the tracks and appurtenances and all other property of the concessionaires located on the public domain, and, during the last five years of the concession, should it appear that the operating company fails to maintain the property in good condition, the state reserves the right to seize all the company's revenues for the purpose of keeping up the same. The state will have the right to take all rolling stock, tools and similar movable property at a valuation fixed by experts, but will be under no obligation to buy more than suits its purposes or wishes. Upon the termination of the concession, should the state deem it useless to continue the operation of certain lines, the concessionaires will be required to remove their tracks and restore the streets to their original condition.

"The state reserves the right to purchase its concession at any time. The price, in such event, will be fixed by the net annual revenue of the seven preceding years, including the fees paid to the city. From the total thus obtained will be deducted the net revenue of the two least profitable years, and the average of the five remaining years will stand as the amount of an annuity, to be paid to the concessionaires during each unexpired year of the revoked concession."

A Useful Form of Electric Heater.

The illustration herewith shows a form of electric heater closely resembling the familiar variety of gas-stove used for heating apartments. This heater is not only adapted for ordinary work in warming the air of rooms, but is useful for boiling water or other liquids. The illustration shows a tea-kettle actively boiling on the top of one of the heaters. The usefulness of such an apparatus is immediately apparent. This heater is manufactured by the Gold Car Heating Company, of New York and Chicago.

A Useful Electric Heater.

Dividends.

The Columbus, Ohio, Street Railway Company has declared a dividend of one per cent, payable August 1. Books close July 21.

The Madison, Ind., Gas and Electric Company has declared a dividend of two and one-half per cent, payable July 21 to stock of record July 10. Books closed July 10 and reopen July 22.

The directors of the General Electric Company have declared a regular semi-annual dividend of $3.50 per share on the preferred stock, payable July 31 to stock of record July 15. Transfer books will not be closed.

Gas Engines for Electric Lighting Service.

Among the numerous electric light systems installed by Messrs. Westinghouse, Church, Kerr & Company, the plant at Attica, N. Y., owned by Mr. F. C. Stevens, of Washington, D. C., stands as an example of high economy and satisfactory service. The plant was installed in September, 1897, and consists of one three-cylinder 55-horse-power Westinghouse gas engine, operating a 45 kilowatt two-phase alternator and one arc machine, both being Westinghouse type. The two dynamos are driven by direct belting, one from either end of the engine shaft. Natural gas is used for fuel for the engine, taken from wells owned by Mr. Stevens.

After about one year's service the load on this engine reached the maximum limit, being over 60 brake horse-power. A second gas engine was then ordered and installed, and the arc machine transferred to this engine. This plant has been visited by many people interested in the use of gas engines for lighting service, and the data secured would seem to prove this gas engine equal to the best automatic steam engine for steady, smooth running and close regulation. The ease of starting these engines is a point much in their favor. The engineer in charge, with a few minutes' notice, can start the engines and have the lights on and the machinery in full operation. This is a point of great value in lighting an office building, or in case of a sudden clouding over of the sky, when a decided increase of load occurs. Such a demand could be met in a few minutes by gas engines, as they do not require draining or warming up. The source of power being available at any moment in the gas-pipe, attention can be centered on the engine, which is quickly in service, and in case of a plant running on the meter system, the paying load is on in less than one-half minute after the gas is turned into the engine. When the extra power is no longer required the expense can be stopped at once by closing the gas valve. This feature alone is a source of considerable economy.

A mortgage for $1,000,000, covering all the property of the New York & Queens Gas and Electric Company in Flushing, has been filed in favor of the Union Trust Company, to secure the redemption of an issue of 1,000 bonds of $1,000 each; a part of the money is to be used in extending the plant.

OPERATING COSTS OF HORSE AND ELECTRIC DELIVERY WAGONS IN NEW YORK CITY.*

BY G. F. SEVER AND R. A. FLIESS.

During the last three years many descriptive articles relating to the automobile have appeared in the technical press, but up to the present time there has been published no definite data which might be used to indicate whether or not electric operation possessed any advantages. Hence both the general, as well as the technical public, could form no definite opinion as to the benefits to be derived from the use, in any particular class of service, of either an electric or a horse system.

The purpose of this paper is to present the results of an investigation, carried on during the past year in the city of New York, of the operating costs of the horse and electric delivery service as at present instituted by the large department stores. This investigation formed part of a graduation thesis in the electrical engineering department of Columbia University.

The present status of the art does not permit of an exhaustive comparison, as some of the data now presented will probably be entirely altered by the rapid developments which are taking place, the art progressing quite similarly to that of the electric railway. That which can be done most successfully is to compare the cost of maintenance of the two abovementioned systems, and if, to-day, an electrical system costs less to operate and keep than a horse system, it is simply a question of a short time as to the replacement of the horse by the electrical method. Of course, in considering the economy of any system, depreciation enters largely as a factor; but in case of any new system, such as is under consideration, the determination of the depreciation of any of the various parts, or of the system as a whole, would be difficult, and for its solution would require long-continued service and close observation. Owing to the short time that the automobile has been in the field in commercial competition with the horse, it has been impossible to collect a sufficient amount of data on this point to make its introduction of value in drawing a comparison between the total operative costs of the two systems.

SECTION I—SOME DATA ON HORSE DELIVERY SERVICE.

The work done by a horse in moving a vehicle over level ground consists in overcoming resistance to motion due to friction; it may be conveniently expressed in foot-pounds. When grades are encountered, the number of foot-pounds of work performed in the same distance, will increase. This additional work is necessary to overcome the force of gravity. When on a descending grade the horse does work in resisting the tendency of the vehicle to accelerate. Hence, when in motion, the horse is continually doing work. The exact amount of work performed by a horse in a day is a very variable quantity. It depends upon many factors, some of which are:

1. Kinds of road surface—macadam, asphalt, etc.
2. The condition of roads traveled over.
3. Topography of the country passed through.
4. Nature of the load.
5. Distribution of the load on the wheels.
6. The horse itself.

The horse is not an automatic machine that can be designed to perform a given amount of work with a given efficiency. It is, on the contrary, a most variable, and at times, willful, source of motive power. The breed, state of health, temperament, environment, adaptation to the load, etc., affecting in a greater or less degree, the amount of work that can be performed in a day by any individual horse. The problem, therefore, of determining the amount of work done by a horse, under any but very regular and systematic conditions, is one of great complexity. But under regular conditions, the amount of work performed may be quite closely approximated. It is proposed in this section to give the results obtained in an investigation which was undertaken to determine, as closely as possible, the average amount of work performed daily by a certain lot of horses engaged in the delivery service of a large dry goods store in New York city.

It may be well to explain in some detail the exact nature of the work required of this class of horses. The large "department stores," as they are now called, have to keep in operation Winter and Summer, irrespective of the weather, a delivery service which must be as regular in the fulfillment of its functions as the local steam railroads and street railway systems are in the execution of their obligations. The nature of the service necessitates a highly organized system of delivery by means of small units capable of carrying 700 to 800 pounds over short distances and with considerable speed. This problem has been met and solved by these stores through the introduction of a horse delivery service composed of many small units, each one of which has its special district to cover and a certain time schedule to follow.

To illustrate more clearly the method pursued, we will follow one of these units through its daily routine. Let us consider the case of a wagon making three deliveries a day. The first delivery starts from the stable at eight o'clock in the morning and arrives at the store a few minutes later—the stable in most cases being not far from the stores. Arrived at the store, the wagon receives its load, which varies from day to day, but which will average the year round, not over 800 pounds. This load may be taken as the average load on all trips as the wagon leaves the store. The load decreases as deliveries are made so that theoretically when the wagon has reached the store again, it should be without load. This, however, seldom happens in practice, as there are many C. O. D. packages in each delivery that must be returned to the store as collection could not be made. Also packages sent out on approval are called for and brought back to the store on each trip. Hence, the load as a general thing, does not entirely disappear before the wagon reaches the store at the end of any one delivery. It may be safely assumed, however, that the average load carried throughout any trip will not be more than 500 pounds. The load having been received, the wagon starts out to deliver its packages.

The following table gives for a certain store, the division of the city into what may be called unit districts, each store having, of course, its own particular scheme of subdivision—this depending upon the volume of its business.

		Deliveries a Day.
1	Canal street to Battery, East and West	2
2	" " " 19th St., E. of Fifth Ave.	3
3	" " " 19th " West of "	3
4	20th " " 40th " " "	3
5	41st " " 59th " " "	3
6	60th " " 75th " " "	3
7	76th " " 90th " " "	3
8	91st " " 105th " " "	2
9	106th " " 125th " " "	2
10	126th " " 145th " " "	2
11	20th " " 50th " East of "	3
12	51st " " 80th " " "	2
13	81st " " 110th " " "	2
14	111th " " 145th " " "	2
15	All above 145th street, East and West.	1

It will be observed that on the longer trips only two deliveries are made a day, while above 145th street only one delivery is made. This latter is an all-day route and the horse that goes up one day comes back the next—horses being changed at the local stable of this particular store near 180th street.

Let us suppose that the wagon has started on trip No. 7, then it will go from that store to Seventy-sixth street without stopping, the first delivery being made in Seventy-sixth street. To make it easier for the horse and to facilitate delivery, the driver does what is called "backloading." This means giving a number of packages to his helper or delivery boy to distribute on foot, while he drives to another street, makes some deliveries and meets his boy again at some prearranged point. By this method the horse is saved a great deal of work and the time of delivery is much shortened. After the deliveries are all made on the way up, say, between Eighth avenue and Amsterdam avenue as far as Ninetieth street—the end of this route—then the wagon comes down delivering between Amsterdam avenue and Riverside Drive to Seventy-sixth street. At this point deliveries stop and the wagon proceeds to the store, there to deposit the money collected on C. O. D. packages and to return undelivered goods. By this time it is usually after 12 o'clock and the wagon goes to the stable to change horses and prepare for its second trip. The horse used on the morning trip is sent to his stall and a fresh one is harnessed to the wagon. The wagon starts out again at one o'clock to load up for another delivery. The same procedure as before is carried out, the wagon usually returning to the stable a few minutes before five o'clock. The horse used during the morning trip is harnessed to the wagon again and starts out on the five o'clock delivery. This horse returns about 7.30 or 8 o'clock. Hence we see that it takes two horses for every delivery wagon—the horse that makes only one trip on any one day, making two trips on the following day, on a route calling for three deliveries each day. On a route having two deliveries a day, each horse makes but one trip a day.

It has been found that the mileage per wagon per day is nearly a constant, irrespective of the number of trips made. The method pursued which led up to this conclusion, was the following: An odometer was placed on the axle of a delivery wagon in the service of one of the large department stores in the city. This wagon was sent over each of the routes specified in Table 1, an accurate record being kept of the number of miles covered by the wagon on each day. This wagon was kept on the various routes in regular delivery service for a period of some three weeks, and the results obtained indicate that approximately the same number of miles are covered by all the wagons in this service each day. This will be readily understood when one considers that a wagon, making a trip over an apparently short route, is in reality covering very much more ground than would at first be thought. The density of population in the district which the route covers materially affects the number of deliveries and consequently the mileage of the wagon. The explanation of the fact that the average mileage per day of the wagons is nearly the same, is that experience extending over many years of service has taught those in charge the best method of district subdivision which will produce such a proportioning of the work that it shall be equally distributed among the units.

In determining the amount of work done per day by one of these delivery horses, it is essential to know the number of miles traveled by the horse, the average draw-bar pull of the wagon, and the average speed of the horse while in motion. To determine these factors one of the authors spent a number of days on his wheel following delivery wagons of many firms, under varying conditions of load and in many different streets. Attached to the wheel ridden, was an accurately tested cyclometer and an equally accurately tested tachometer. A notebook, pencil and watch completed the outfit, and the following is an illustration of the method pursued in determining the amount of work done by horses attached to delivery wagons in New York city.

The draw-bar pull of the wagon was determined by the use of a traction dynamometer. For the wagons under consideration, it was

* Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, Boston, June 28, 1899.

found that the average pull per ton was 60 pounds on ordinary cobblestones, at a speed of 7 miles per hour. On asphalt the draw-bar pull was found to be 40 pounds per ton, at 7 miles per hour. The unit under consideration was composed of a wagon weighing 1,300 pounds, drawn by a horse weighing 1,100 pounds. Each wagon is provided with a driver and a delivery boy. The average weight of the driver may be taken at 150 pounds, and that of the boy at 125 pounds. Hence the total weight of the unit, without load, was 2,675 pounds. To this must be added the average load, which may be considered as being 500 pounds. Adding this to 2,675 pounds, we have as the total weight of the unit 3,175 pounds. The weight causing the draw-bar pull, however, is 2,075 pounds. The test was, approximately, one-half on cobblestones and one-half on asphalt. The true average draw-bar pull may then be taken as having been 50 pounds per ton during the test.

From the data we find that, starting from the store, the average speed while in motion was 6.7 miles per hour. The actual running time was 1 hour 36 minutes; time at rest, 2 hours 28 minutes.

From the time the horse left the stable until he returned to it was 4 hours and 52 minutes. The time taken to load at store was 46 minutes. The time to run from stable to store was 2 minutes. Hence, the actual time the horse was working from the time he left the stable until he returned to it was 1 hour and 38 minutes; time at rest, 3 hours and 14 minutes.

It will be noticed that the horse was at rest and doing no work for nearly two-thirds of the time.

Taking the draw-bar pull as found, at 50 pounds per ton, the number of foot-pounds of work done by the horse in traveling 11 miles was $50 \times 58{,}080 = 2{,}904{,}000$ foot-pounds, or at the rate of 1,781,596 foot-pounds per hour, which is at the rate of 29,693 foot-pounds per minute. This delivery horse, then, exerted nearly .9 of a theoretical horse-power for 1 hour and 38 minutes. This was all the work done by this particular horse on this day. The following day this same horse made two trips over the same ground. From these data the average work done per day the year round by a horse in this class of service may be taken to be not over 16.5 miles at 50 pounds per ton, at a speed of 7 miles per hour. Other data bear out this conclusion. It is quite probable that, on some special occasion, a horse may be called upon to do more than is shown above, but the average work, day by day, for the year is not more than this. In fact, experience has shown that a horse in delivery service in New York city can not average over 15 miles a day for six days a week, and be expected to render good service for any reasonable length of time.

The length of the working life of a horse in this service is seldom over five years. At the end of this time he has depreciated in value at least 50 per cent and can not be sold for more than half his original cost.

The time that a horse is in harness per day the year round will not average more than 7 hours, and we have seen that he is only working a small fraction of this time. However, for the purposes of this paper, it will be considered that a horse can do a greater amount of work, day in and day out the year round, than experience has indicated that he accomplishes.

We will assume, therefore, that it is possible for a horse to do 21 miles a day under a draw-bar pull of 50 pounds, at 7 miles per hour, and be in harness 8 hours a working day the year round.

The number of foot-pounds of work done per day by a horse, under this supposition, would be 5,280,000. This is at the rate of 29,333 foot-pounds per minute, or the horse is working at the rate of .89 of a theoretical horse-power for three hours per day. This, of course, refers only to the time in actual motion.

Having established the amount of work that a horse is to do per day, it is now necessary to ascertain how much it costs to do this work. The basis upon which this calculation can most readily be made, for comparison with other values, is the ton-mile; that is, how much it costs to transport a ton one mile over a level road under ordinary conditions, the ton weight to include everything that enters as a factor in causing the draw-bar pull of the wagon. These factors are the weight of the wagon, weight of driver and boy, and weight of load carried. In order to facilitate the calculation, the data collected have been condensed into a table and are given below. This table represents the results of a personal canvass of a large number of stables for delivery and for general livery service. The figures given are the lowest that were procurable in New York city.

TABLE OF ITEMS ENTERING INTO THE CALCULATION OF THE COST OF MOVING A TON A DISTANCE OF A MILE ON LEVEL GROUND, IN LIGHT DELIVERY SERVICE IN NEW YORK CITY.

1. Cost of food per day for one horse...	32.00 cts.
2. Interest on cost of wagon (at 6 per cent per annum) per day, original cost of wagon, $312.....	5.13
3. Interest on cost of horse (at 6 per cent per annum) per day, original cost of horse, $125	2.06
4. Interest on cost of harness (at 6 per cent per annum) per day, original cost of harness, $55.....	.90
5. Part of stable rent charged to each horse per day..... (Cost of stable, $40,000. Interest at 6 per cent = $2,400.) 46 horses in stable, part of rent chargeable to horses = $1,578.55.	9.39
6. Part of stable rent chargeable to each wagon per day, 24 wagons in stable. Part of rent chargeable to wagons= $822 85.	9.39
7. Part of cost of attendance chargeable to each horse..... 4 men to take charge of 46 horses at $11 a week per man—$44 a week for care of horses.	13.66
8. Shoeing p r horse per day ($2 per month a head, the year round).....	6.60
9. Driver per wagon per day, $12 per week	171.42
10. Boy helper, $8 per week	111.28
Total cost of 1 wagon, 1 horse and attendance per day.....	364.83 cts.

It is to be understood that this table represents the actual cost per day, to a stable in the city, for a wagon and horse, the figures given being those of a stable connected with one of the large dry-goods houses in the city.

Assuming 500 pounds as the average load carried by any one wagon per day, the total weight of the unit which causes the draw-bar pull as found before, is

Wagon	1,300 lbs.
Driver	150 "
Boy	125 "
Load.....	500 "
Total.....	2,075 "

Hence, draw-bar pull being taken as 50 pounds, the cost to move 1 ton 21 miles may be taken as 364.83 cents, the cost per ton-mile being then 17.373 cents.

Taking another case where the two horses and the delivery wagon are considered, and assuming the most ideal conditions, we find the following:

Supposition:

One wagon making three deliveries a day of 800 pounds each—assuming 500 pounds average load as before, making a total delivery per day—2,400 pounds.

To do this will require 2 horses, 1 wagon, 1 driver and 1 boy. The cost per day of this outfit from Table III is as follows:

1. Food for 2 horses.....	64
2. Interest on cost of 2 horses.	4 12
3. " " " " wagon	5 13
4. " " " " 1 set of harness.....	9
5. Stable rent chargeable to 2 horses.....	18 78
6. " " " wagon	9 39
7. Attendance on 2 horses....	27 32
8. Shoeing for 2 horses.....	13 20
9. Driver	171 42
10. Boy.....	114 28
Total....	428 54

The cost of delivery per pound is then .17856 cent. If we assume that in doing this work the wagon was out 12 hours and is in motion one-half its time, going at a speed of 7 miles per hour while in motion, then the wagon will cover 42 miles per day. Under these conditions the cost per ton-mile is 10.2 cents. This is also the cost per car-mile.

If we consider the load only, it costs 10.2 cents per 500 pounds per mile, or at the rate of .0204 cent per pound per mile.

If we assume that on the three trips the deliveries average 50 per trip, then 150 deliveries were made per day. This is at the rate of 25 deliveries an hour or 1 delivery in 2.4 minutes. It is well to call attention here to the fact that a wagon sometimes is called upon to make as high as 100 to 150 deliveries on a single trip and the average rate of delivery may be taken as not over 25 deliveries an hour. Hence it is evident that the case considered in the above table is for ideal conditions only. The weight per package under our supposition is 16 pounds, and it is not often that the packages will average over 10 pounds.

The results deduced, it will be understood, represent the lowest possible figure under the conditions now existing in the stable under consideration. Therefore, if in making a comparison between the costs of operating a horse and an electric delivery service under identical conditions, the above figures are used, all possibility of error in favor of the electric automobile would seem to be eliminated.

SECTION II—SOME TESTS ON ELECTRIC AUTOMOBILES FOR DELIVERY SERVICE.

The results recorded in this section were obtained under service conditions, in the streets of New York city. Over 60 miles were covered during the tests recorded below, and all grades between the lower section of the city and Washington Heights were surmounted with the greatest ease. During the tests, various conditions of weather were encountered, including heavy rain, strong head winds and muddy streets, as well as very clear weather, no wind, and dry streets.

During the series of tests, no accidents of any kind happened. It was not necessary at any time to stop the vehicles for repairs—all the mechanical and electrical parts performing their functions with the utmost ease, and with practically no noise, and absolutely no odor.

The method followed during all the tests was the same. It consisted in measuring the watt-hours of energy supplied by the storage batteries during the runs, by means of a Thomson recording watt-hour meter, which was accurately calibrated before the test began. The distance traveled by the vehicles was recorded by a tested cyclometer, and the speed in miles per hour was noted at any second by means of a tachometer. Placed in series with the watt-hour meter was a Weston portable ammeter, while a Weston voltmeter was placed across the battery connection at the controller. In this way, instantaneous readings of the power were obtained, while the watt-hour meter gave the total energy used. The Weston instruments were accurate, and every precaution was taken to guard them from any jolts or jars which might have impaired their accuracy.

The first tests to be presented were made upon a vehicle built for a large dry-goods store in New York city. The vehicle was intended for the delivery of light goods about the city, and was to be placed in competition with horse-delivery service of the same class. The results show that the power consumption is not greatly affected by change of pavement, as from cobble stones to asphalt.

On grades the speed of the vehicle is very much reduced and the power required to propel the vehicle at the reduced speed is very large—which is quite natural. It must be remembered, however, that the comparison is made in this case between level asphalted streets and macadamized hills that were very muddy, and that this condition would cause the variation in power to be greater than in the case of grades of asphalt surface. The average of 10 readings gives as the power consumed on level asphalt the following:

Volts.....	85 3
Amperes.....	23.1

It is to be understood that these 10 readings were selected from the table with the idea of eliminating up or down grades. The lowest ammeter reading taken was 20 and the highest 26. Above and below these readings the vehicle was on perceptibly up or down grades. It may be well to note that this wagon was equipped with solid rubber tires; these, as is quite generally recognized, absorb slightly less power than pneumatic tires.

(To be concluded.)

ADVANCE INFORMATION

New Incorporations.

TRENTON, N. J.—The Electric Axle-Light and Power Company has been incorporated to manufacture electric, compressed or liquefied air machines for lighting, heating and refrigerating; capital, $25,000,000.

SAN FRANCISCO, CAL.—The Truckee River General Electric Company has been incorporated for the purpose of transmitting power for light and heat throughout the state. The capital stock is $2,500,000. The directors are Mortimer Fleishacker, Sigmund D. Rosenbaum, Albert J. Hechtman, Frank H. Buck, Ludwig Schwabacher and Herbert Fleishacker.

WHEELING, W. VA.—The National Light, Heat and Power Company has been incorporated; capital, $500,000; incorporators, J. Piedell, J. A. Miller, C. H. Copp, J. T. Adams, all of Wheeling; R. C. Dalsell, of Leatherwood.

WHEELING, W. VA.—The Ohio Valley Electrical and Motor Power Company has been incorporated; capital, $500,000; incorporators, M. Horkheimer, F. H. Lange, H. W. McLare, C. M. Fressell, J. F. Coniff, all of Wheeling.

NEW YORK, N. Y.—The Electric Mining Company has been incorporated; capital, $1,000,000; incorporators, C. A. Gregory, A. J. Smith, A. W. Bourne, R. C. Cook, W. Richardson, all of New York city.

NEW YORK, N. Y.—The United States Gas and Electric Improvement Company, of Mexico, has been incorporated; capital, $5,000,000; incorporators, H. H. Barnes, D. Barnes, H. Richmond, J. Barnes, E. Barnes, all of New York city.

MORRISTOWN, N. J.—The New Jersey Engineering and Construction Company has been incorporated to construct and equip gas and electric plants; capital, $25,000; incorporators, Frederick N. Taff, Millington, N. J.; Frederick W. Schmidt, Louis C. Bonnell, of Morristown, N. J.

CLEVELAND, OHIO—The General Incandescent Lamp Company has been incorporated to manufacture and deal in electrical machinery and electric lamps; capital, $50,000; incorporators, J. Insull, F. H. Goff, T. H. Bushnell, S. H. Tolles, J. McGregor, Jr., all of Cleveland.

COHOES, N. Y.—The J. W. Tindall Company has been incorporated to manufacture electrical appliances for medical and surgical use. The capital stock is $3,000.

BALTIMORE, MD.—The Hill & Miller Company has been incorporated; capital stock, $50,000. The company will manufacture electric and mechanical apparatus.

JERSEY CITY, N. J.—The Rockaway Electric Light and Improvement Company has been incorporated to construct and operate gas and electric light work; capital, $15,000; incorporators, Anthony Blum, Brooklyn, N. Y.; Kent K. Stearns, Jersey City; Isaac Blum, New York city.

SYRACUSE, N. Y.—The Independent Telephone and Telegraph Construction Company has been incorporated; capital, $5,000; directors, Ernest I. White and Edward Barneman, Syracuse; J. J. Jernigen and John L. Wentz, Scranton, Pa.

PAINESVILLE, OHIO—The Painesville Targon Company has been incorporated for the purpose of furnishing heat and electricity; capital, $27,000; George H. Burrows and others, incorporators.

New Electric Railways.

BERRYVILLE, VA.—There is some talk of building a trolley line from Winchester to this place.

COLORADO SPRINGS, COLO.—The Colorado Springs & Cripple Creek Railway Company has been incorporated by E. W. Giddings, Jr., J. F. Burns, J. R. McKinnie, H. G. Lunt and S. M. Woods. The company will build and operate a railroad between Colorado Springs, Cripple Creek and Victor, the incorporation to extend for a period of 20 years. The company is capitalized at $2,000,000. The principal office of the company will be located in Colorado Springs. Branch offices will be located in New York city and other eastern cities. The directors for the first year are Irving Howbert, E. W. Giddings, J. F. Burns, J. R. McKinnie, S. M. Woods, K. R. Babbit, J. G. Burton, H. G. Lunt and W. H. Hoagland.

GALENA, KAS.—The Southwest Missouri Electric Railway Company, known as the Interurban, which operates 37 miles of track in the Missouri-Kansas lead and zinc district, will spend $200,000 immediately in extensive improvements, doubling many miles of track and constructing a new line from this city to Riceville, Kas., and later on to Baxter Springs, Kas., a distance of eight miles. Many new cars are being built by the Laclede Car Company, of St. Louis, which will be used on this end of the system. The power-house at Webb City will be enlarged and new ones will be constructed at Carthage, Joplin and Galena. New carsheds will be built at Webb City and Galena. With these extensions and improvements the road will be one of the finest electric systems in the Southwest.

BOSTON, MASS.—The new electric car line of the Boston, Milton & Brockton Street Railway Company, through the town of Milton, has been opened to the public.

COLUMBUS, OHIO—The Columbus, Winchester & Lancaster Traction Company has been incorporated to construct an electric railway; capital, $10,000; incorporators, T. A. Simons, D. C. Beggs, R. E. Jones, H. C. Park, T. B. Beatty, F. Post, all of Columbus.

YONKERS, N. Y.—The Union Trolley Company has petitioned the Board of Aldermen for permission to extend its lines in Central Park avenue from Yonkers avenue to the New York city line, thus connecting with the Union line, which runs to Woodlawn Cemetery; also along Nepperhan avenue, Sawmill River and Tuckahoe roads to the northerly line of the city, thence easterly to Tuckahoe; also in the Bronx River Road, near Mount Vernon, to its intersection of McLean avenue to Broadway, in Yonkers; also at the intersection of Palisade avenue and Shonnard terrace, northerly in Palisade avenue to Odell avenue. The aldermen decided to have a public hearing on the petition on July 27.

New Telephone and Telegraph Companies.

BUCHANAN, VA.—The Botetourt Telephone Company has been incorporated; capital, $5,000; incorporators, H. A. Latane, O. E. Obershain, J. Z. Schultz, of Buchanan; J. C. Brewbaker, of Botetourt; W. R. Allen, T. McDowell, of Fincastle.

FALMOUTH, KY.—Efforts are being made to establish a telephone exchange at this place.

BEATRICE, NEB.—The Clatonia Telephone Company has been incorporated; capital stock, $5,000; incorporators, Zig Barkey, F. W. Jones, J. H. Steinmeyer, Henry Jones and Henry Albert.

OCONTO, WIS.—The Wisconsin Bell Telephone Company is putting in a new line between this city and Stevens Point. It will be a metallic circuit, and will touch Oconto Falls, Lena, Stiles, Gillett and other important points along the route.

CIRCLEVILLE, OHIO—At the regular meeting of the City Council held a few days ago, the North Electric Company, of Cleveland, Ohio, presented an ordinance, asking for a franchise to erect a telephone system in this city.

WATERTOWN, N. Y.—The Citizens' Telephone Company has been incorporated with the Secretary of State; capital, $50,000, and the general route is in and through the streets of Watertown and Jefferson County. The directors are S. C. Sherman, S. F. Bagg, Robert J. Buck, of Watertown; Robert Bliss, Howard Gallup, Robert S. Monroe and James K. Whitaker, of New York city.

Electric Light and Power.

TOMS RIVER, N. J.—Toms River Light and Power Company has been incorporated, with a capital stock of $25,000.

ST. PAUL, MINN.—The Coon Rapids Power Company has been incorporated. The company will at once proceed to erect the much-talked-of dam between Coon Rapids and the northern boundary of the city, and the power thus obtained will be transformed into electricity and wired all over the city. The incorporators are Thomas Lowry, C. G. Goodrich, Mart B. Koon and Frederick Weyerhaeuser, of St. Paul. The capital stock of the corporation is $200,000.

JEFFERSONVILLE, IND.—The Jeffersonville Light and Power Company has been incorporated, with a capital stock of $9,500, and J. C. Knight, H. C. Knight and L. A. Ivins as directors.

SOUTH BRAINTREE, MASS.—At the special town meeting the citizens authorized the negotiation of a loan of $23,000 to increase the efficiency of the electric light plant. A committee, composed of Messrs. John Kelley, Willard Dow, S. T. Stevens, B. F. Dyer, John Cavanaugh, A. O. Clark and W. E. Maybury, has been appointed to take charge of the work.

A Monument to Duchenne.

At the approaching meeting of the French Association for the Advancement of Science at Boulogne, a monument of Duchenne, known for his contributions to electro-therapeutics, will be unveiled. The association will for the first time have a subsection of electro-physiology.

An Electrical Manufacturing Company to Start in New York.

A new electrical manufacturing company is now being organized which will operate a factory in New York city. The company will be known as the Falcon Electrical Manufacturing Company. It is said that Mr. Edward Lessner, a large carpet manufacturer, and others are the capitalists behind the new organization. Mr. L. E. Frorup, a well known electrical man, who has been identified with the General Incandescent Arc Light Company and recently with Schiff, Jordan & Company, of Vienna, and Mr. H. O. Swoboda, of the General Incandescent Arc Light Company, will be prominent in the company.

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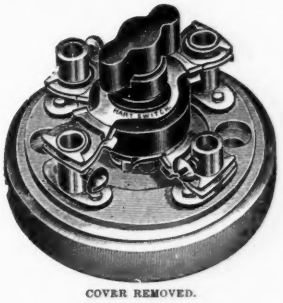

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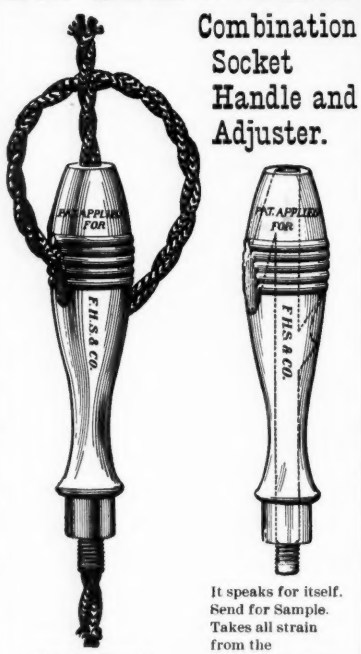

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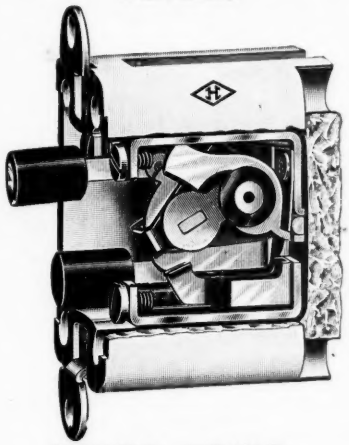

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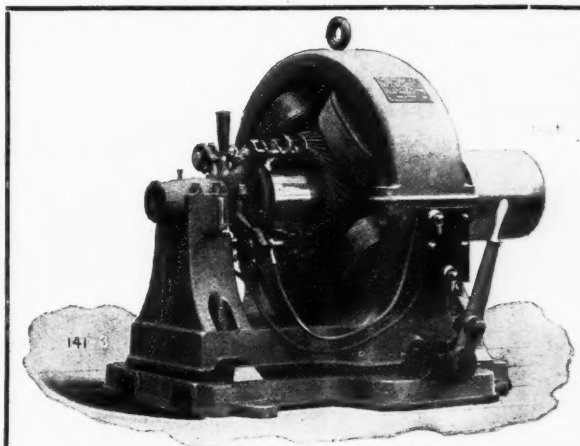

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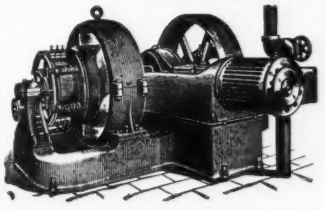

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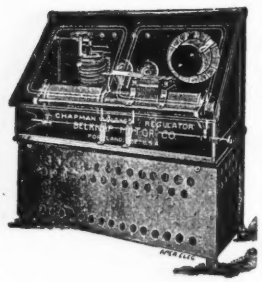

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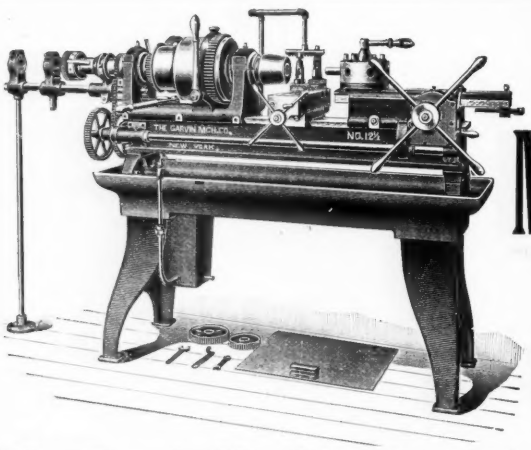

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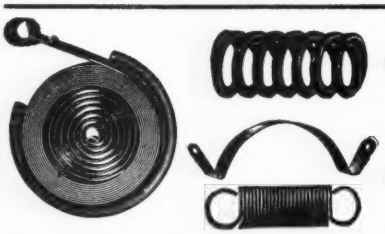

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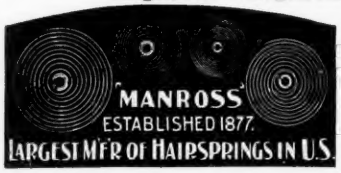

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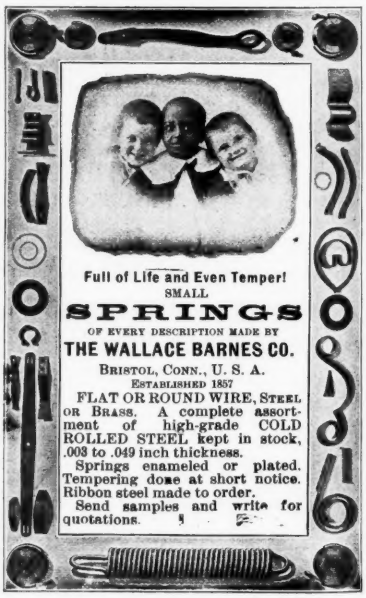

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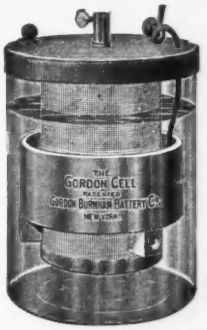

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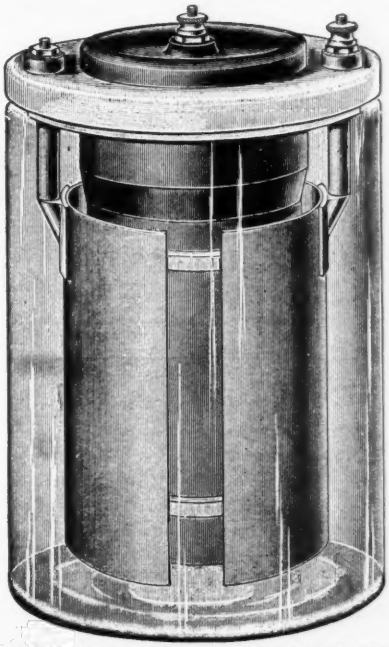

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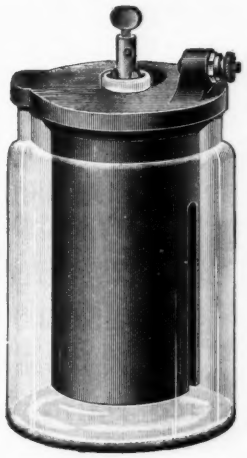

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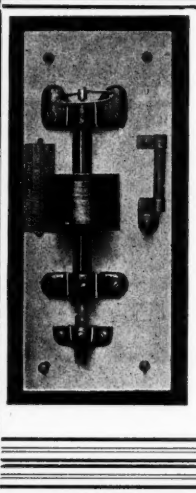

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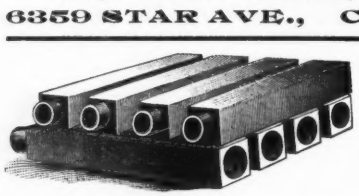

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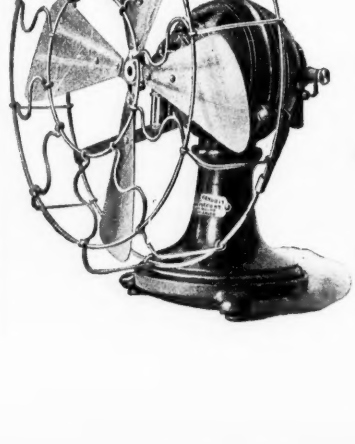

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